REPORT

ON

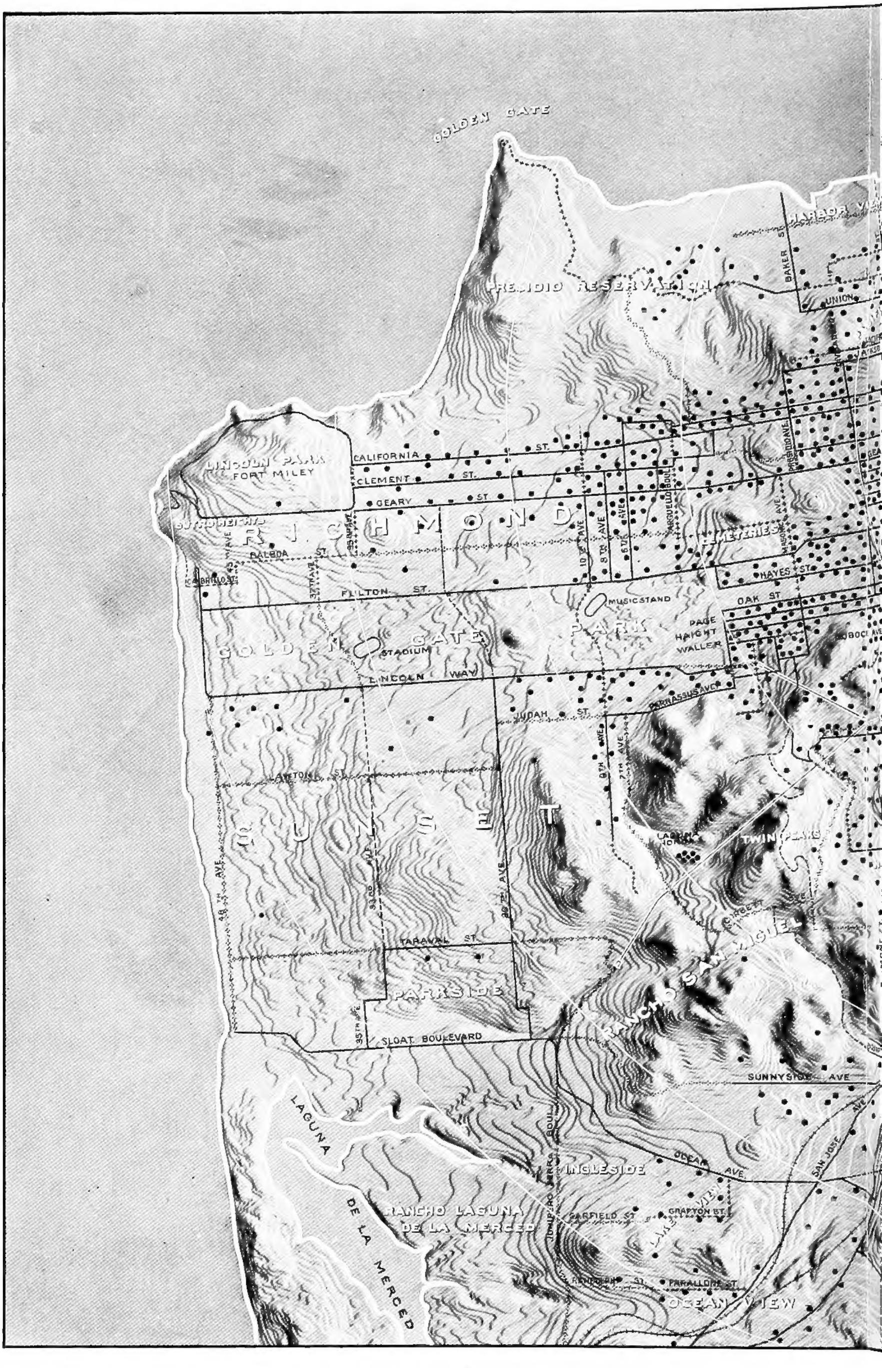
Transportation Facilities
City of San Francisco

BY

BION J. ARNOLD

FRONTISPIECE A—THE PROBLEM OF TRANSPORTATION IN SAN FRANCISCO.

Ceremony of the unveiling of the Tetrazzini tablet at Lotta's Fountain, 1912. This is a panoramic view looking up and down Market Street at its intersection with Third, Kearny, and Geary Streets, the business center of San Francisco, and the most congested traffic point. Here the new Municipal line on Geary Street will cross to the outer tracks on Market Street to the Ferry terminal. This clearly illustrates the enormous concentrated traffic street railways are called upon to handle and the necessity of much emergency special work in the loading district to enable car service to be maintained during such interruptions of the main artery.



FRONTISPIECE B.—RELIEF MAP OF SAN FRANCISCO WITH DISTRIBUTION

This map affords a graphic picture of the influence of existing topography in t lines. One dot represents 200 people, based on sleeping population only, as determ San Francisco are clearly distinguishable, also the extensions thereto planned for bo and tunnel projects are indicated by white lines.

ON OF POPULATION IN 1910 AND RAILWAY LINES PRESENT AND PROPOSED.

n the settlement of the city, and the absolute dependence of the people upon transit
mined by the 1910 census for each enumeration district. The unsettled areas of
both present and future construction. Contours are shaded in at 20-foot levels,

REPORT

ON THE

IMPROVEMENT AND DEVELOPMENT

OF THE

TRANSPORTATION FACILITIES

OF

SAN FRANCISCO

SUBMITTED TO THE

MAYOR

AND THE

BOARD OF SUPERVISORS

City of San Francisco

BY

BION J. ARNOLD
Consulting Engineer

San Francisco, March, 1913

Price $1.00

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*Previously presented as preliminary reports.

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LETTER OF TRANSMITTAL

To the Honorable Mayor
and Board of Supervisors,
City and County of San Francisco.

Sirs:

In compliance with the engineering commission entrusted to me through Resolution No. 8725 (New Series), and subsequent resolutions, to "advise the Board of Supervisors as to what action it should take in order to improve the transportation facilities of this city," I have the honor to present in this final report my conclusions and recommendations in full upon the transportation problem of San Francisco.

Owing to the necessarily comprehensive character of this investigation, and the special subjects submitted to me for study, I have deemed it expedient to submit to you from time to time preliminary reports on subjects of greatest urgency, all of which, revised to suit the conditions as they now exist, are included herein.

Some of these special studies, such as tunnels and subways, while urgent, were somewhat foreign to the immediate subject of transit improvements; but the necessities of the moment, largely due to the pressure of work entailed upon your City engineering department by the Hetch Hetchy investigation, relating to water supply, necessitated undertaking much routine work which considerably delayed the major work in hand.

The expenses of this investigation have been approximately detailed as follows in order that you may have a proper understanding of its scope and the advisability of its having been continued to finality:

Rapid Transit Tunnels and Subways	19%
Franchise Plan and Charter Amendments	14%
Traffic and Service Survey	13%
United Railroads, Investigation of System	21%
Municipal Cars and System, Exposition Transportation, Improvements in City Plan, Future Growth of District, Steam and Water Terminals, and Research and General Office Work	33%
	100%

Many valuable suggestions and criticisms have been tendered by the various civic bodies and individual citizens, and to them I

hereby extend my appreciation, as well as to my local organization for faithful performance of the arduous duties of this investigation.

As far as permissible, considering the special training required, I have endeavored to organize this local force from San Francisco men having direct knowledge of your city.

The report is presented in sections to permit of convenient subdivision of such a comprehensive subject, and according to my understanding of your needs, supplemental discussions of the more important phases have been included with a view of presenting cogent reasons for my conclusions and recommendations. Otherwise, many of these conclusions might not be evident, or might be entirely misunderstood. For the benefit of those desiring only a broad view of the subject there follows in the "General Review" a resumé of the salient points discussed later in detail.

In the course of this major investigation, both the present and future needs of your city have been exhaustively studied with due regard for the lessons of the past. Definite recommendations are made, in all cases bringing to bear upon local problems experience gained in the investigation of similar ones in other cities. And I have especially endeavored to develop a transit plan upon these broader lines, although necessarily giving due consideration to the minor needs of the present.

The only limitations experienced have been due to the incompleteness of essential records, both of City and Company, partly through the results of their destruction in the great fire. These limitations debar conclusions as to the corporate financial status of the United Railroads, which however is a matter entirely in the hands of the State Railroad Commission, according to my interpretation of the Public Utilities Act, and is not directly involved in or within the scope of the determination of service under the regulative powers of the municipality.

After much study of the existing transit system, I am convinced that the franchise situation is by far the major factor in the solution of present and future traction difficulties, upon which, in my judgment, immediate efforts should be centered. The "Chicago plan," when perfected in the light of direct experience with its operation, holds in my opinion the fullest possible measure of hope for a greater San Francisco, unified under such a plan of logical, harmonious development. After exhaustive study of alternatives, I firmly believe that under its present financial organization, your city will be able, by this means, to realize sooner than by any other the manifest desire of its citizens, as definitely expressed in your Charter and the platform of your last municipal campaign—namely, *ultimate municipal ownership*.

Throughout this work, I have endeavored to maintain an absolutely impartial frame of mind as between municipal and corporate interests, with a view of conserving to the greatest possible extent the best interests of your citizens, which in the end constitute the sole object of municipal government; and no prejudicial criticism has had the slightest weight in the determination of conclusions reached.

I desire to express my appreciation of the co-operation of your Honorable Body, the officials of the United Railroads in traction matters, and of the Southern Pacific, Key Route, and Northwestern Pacific systems relative to commuter travel; for in the absence of the voluminous data submitted relative to property and operations, this investigation would have been seriously handicapped. This compliance in an impartial investigation and criticism confirms my belief that, in spite of past misfortunes, the company first mentioned, as well as those in many other cities, would welcome and participate in a reasonable, sane, and just solution of the present difficulties, in order that the interests of both the Public and the Investor may be conserved and developed to the fullest possible extent.

Respectfully submitted,

Bion J. Arnold

Consulting Engineer.

San Francisco, March 31st, 1913.

GENERAL PROGRAM OF TRANSIT DEVELOPMENT

I—FOR THE CO-OPERATION OF CITY AND COMPANY

Negotiate some form of resettlement franchise with indeterminate, amortizing, profit-sharing and regulative features.

Agree upon a reasonable apportionment of extensions, between private and municipal lines, or else a basis of rental.

Establish a combined operating plan for lower Market Street, with improvements in location and type of safety stations.

Establish an improved plan for routing and distribution of service in accordance with traffic requirements.

Follow plan of most direct radial trunk lines and distinct cross-town laterals, as far as permitted by street layout.

Establish alternate stops in short-block districts, and fast limited service to suburbs.

Perfect City ordinances so as to remove unnecessary restrictions and facilitate passenger transit.

Provide for through route plan of operation with suitable rentals for use of municipal tracks.

Standardize rolling stock, preferably to the Chicago standard of car width and track centers, so as to preserve maximum roadway.

Develop special type of car for hill service.

Work out plans for universal transfers and track rentals, to provide direct transportation to the Exposition for a single fare.

Expand and perfect present surface lines so as to provide feeders to an ultimate rapid transit system.

Develop jointly with Ocean Shore and Southern Pacific Companies electrification of existing steam lines for suburban transportation.

Develop new union railroad terminal station suitable for such electrification.

Develop cross-town service lines with transfer facilities.

II—FOR THE COMPANY

Defer secondary dividends until property is built up to a proper standard.

Increase appropriation for general repairs and maintenance.

Provide an adequate depreciation reserve fund in cash or quick assets.

Increase rehabilitation schedule, especially on track work, until the system is fully standardized.

Plan for the building of 70 miles of extensions now necessary as soon as franchise conditions permit.

Extend thereafter at least in proportion to the growth in population until development of surface system approaches sufficiency.

Provide immediately for 85 additional modern cars now necessary, *i. e.,* 20 more than now ordered.

Increase equipment at least 35 cars per year (cumulative), or more if service standards require.

Rebuild non-prepay cars, improve prepay platforms, or retire obsolete equipment from regular operation.

Enlarge inadequate cable equipment for double-end operation.

Institute recommended improvements in service and operation.

Enforce revised trainmen's rules for the operation of cars.

Designate and adhere closely to fixed stopping points.

Continue traffic observations in order to maintain definite service standards developed herein.

III—FOR THE CITY

Enact transit regulative ordinance based on findings of this report, for improvement of service, equipment and operation.

Establish advisory transit bureau for investigation, record and maintenance of service standards.

Formulate a general franchise ordinance operative under Charter Amendment 34.

Re-submit Charter Amendment 34 at earliest possible date.

Re-submit amendment creating an impartial technical commission for the regulation and administration of utilities.

Re-submit amendment exempting revenue-producing bonds from municipal debt limit.

Construct Harbor View, Twin Peaks, and possibly Church Street tunnels as soon as possible.

Organize City Planning Commission to carry out needed improvements for facilitating rapid car operation.

Enforce contour plan of subdivision of hillside property.

Extend traffic regulation to cover size and type of vehicles and plan of special traffic routes.

Develop definite transit policy that will invite private investment until purchase of utilities becomes possible.

Consider Metropolitan District Control for Bay cities and commuter district.

IV—FOR THE PUBLIC

Avoid accidents by not boarding or alighting from cars when in motion.

At heavy loading points where extra conductors are stationed, use forward as well as rear entrance.

Facilitate rapid loading by having the exact fare ready.

Avoid delay by signaling for a stop before the street desired is reached.
Form the habit of moving forward in the car promptly, thus encouraging others to do likewise.
Smokers use only forward open sections, to reduce congestion at the rear.
Use the forward exit gate under ordinary circumstances.
Avoid abuse of transfer privilege by stop-overs or round-trip riding on a single fare.
Do not expect all routes in the city to be run on Market Street.
Consider one block's walk to a car line as reasonably convenient service, and no hardship.
Do not insist on the imposition of special stops upon an already slow schedule.
Report promptly to the Company serious infractions of discipline.

LIST OF IMPORTANT EXHIBITS

GENERAL REVIEW OF REPORT

In the following topical review, space forbids more than the briefest mention of what may be termed the "mile posts" in the development of an adequate transit plan for San Francisco. To facilitate convenient reference, the same order of treatment has been followed as in the main report, each chapter of which itself comprises a summary of conclusions and recommendations. It is expected that only a general impression of the magnitude and scope of the problems confronting the City will be obtained from this review, which has been prepared for those who have not the time to study the report in detail.

PART I.—GENERAL PROGRAM

Present Transportation Conditions. San Francisco differs entirely from most cities of the East in having achieved its rapid development within the short space of sixty years. It unquestionably faces a still greater growth as a direct result of the Panama Canal. And the city has been greatly handicapped in its proper development by the lack of appreciation of the problems of the future, as well as lax municipal control, and failure of the utilities to keep pace with the city's rapid growth in the past. This especially concerns transportation, which must precede settlement. While the climatic conditions are ideal, the rugged topography has resulted in isolation of local districts, which absolutely requires the construction of tunnels and the execution of a City Plan that will correct present obvious errors by means of wider streets and contour subdivision of property. Only by thus welding together these districts will it be possible to conserve the unusual liberality of its citizens, as exhibited in the high street railway earnings per capita, for the prime objects of civic expansion, with one city, one fare, universal transfers, centralized operation, minimum investment, and finally municipal ownership if the city's present policy continues to prevail. Eventually a Metropolitan District plan of control of utilities and industries may then be developed. The inability of this city to secure utility extensions simply brings into the limelight the fundamental defects of the present situation—complicated franchises, impossible charter provisions, unexercised regulative powers, uncertain stability of investment, deferred rehabilitation of property, curtailment of service, and lack of confidence in present and future. In the meantime, surrounding communities are capitalizing this uncertainty, assisted by concessions in fare and time of transit denied to San Francisco's logical outlet—the Peninsula—

through lack of adequate transit facilities. The obvious and only certain remedy lies now within the power of the City by grasping its opportunities before it is too late and effecting a solution *not piecemeal,* but based upon the broader lines of effort indicated in this report.

Growth of City and District. San Francisco's present problem deals with a metropolitan city of a half-million, and a tributary commuter district of one-third million inhabitants. But the future is of even greater importance, and any transit plan would be hopelessly short-sighted that did not furnish an adequate conception of the financial burdens to be imposed upon a city embarking into municipal enterprises. Manifestly, any policy based upon expediency alone must of necessity be subject to the same if not greater danger of ultimate failure than has been the result of short-sighted private enterprise in the past. A careful analysis of growth shows that the loss in population due to the fire has been more than made up; that the exodus to trans-bay communities has practically ceased; that the growth of San Francisco is now more rapid than ever, and that a city of one million inhabitants will have to be provided for within from 25 to 40 years or less, with every reasonable expectation of corresponding rapid growth of the entire Metropolitan District. Compared with other cities, San Francisco shows the maximum patronage of transit facilities, and according to the general law, its railway traffic and earnings should *quadruple* when the population *doubles.* To fulfill this great increase, it is known that the necessary investment in surface street railways alone will be at least 3:1—*i. e.,* $3 expended for extensions and improvement of the property for each additional $1 earned. But the purchasing power of the City, based upon its property valuation, is increasing at a *much slower rate* than the earnings and investment, which means that if complete municipal ownership is not now possible, it will become more and more impossible in the future unless valuation increases at a faster rate or revenue producing utilities be removed from the bond limit. If San Francisco were *entirely free from debt,* about one-third of its total bonding capacity would have to be reserved for investment in surface street railways alone upon the present bond basis. The City now faces a situation in which the track mileage extensions are at least six years behind the advance in settlement; the car service capacity is inadequate, and probably less than before the fire; and to fulfill the demands of the present and future, probably 15 miles of track per year will be needed up to 1920, with a corresponding average increase in equipment of 40 to 50 cars per year, to say nothing of a large amount of rehabilitation work necessary on the present lines. This program calls for large expen-

ditures, which cannot in any sense be fulfilled by building a few blocks of track here and there throughout the city. The major defect lies deeper, and requires more comprehensive treatment.

Development of Transit System. Two plans of transit extensions have been worked out covering the entire city: (a) complete municipal system, partially competitive; (b) unified system, non-competitive, designed for maximum development of the territory covered with minimum investment. These extensions, classified as "immediate," "five years," and "ultimate," were only arrived at after a study of topography with reference to actual location of population. Cross-town lines have been regarded as essential parts of a radial transit system. Any comprehensive municipal system necessitates joint operation over sections of existing tracks under the State five-block law, in lieu of which such a system would be practically impossible except by purchase. Considering the minimum needs of the immediate future, 72 miles of single track are involved, costing nearly $6,000,000, exclusive of tunnels. After about five years, 50 miles more will be needed. The question of investment is therefore the immediate crux of the problem.

Of the needs of the various districts, those of the Panama-Pacific Exposition site are certainly the most pressing. The present service capacity is barely one-third of that necessary, with only one line—Polk Street—in any sense adequate for maximum service, and this terminating over one mile from the main court of the Exposition. However estimates may vary as to the record attendance, a weekly maximum travel of 50,000 people per hour probably represents the greatest demand for which street railway investment seems warranted. This represents more passengers than travel to their homes during the rush hour of a normal business day in San Francisco. Unless tunnels are constructed, parallel lines will be necessary, with duplication of investment. Under limitations of street congestion and grades, 30 seconds headway, 100 passengers *average* per car, or a total capacity of 12,000 persons per hour, represents the ability of service through *each available entrance throat,* which is the controlling factor. This exceeds the total travel on Market Street during the evening rush hour.

Rapid Transit Development. While extensive studies of rapid transit by means of subways appear to be hardly warranted under present conditions in San Francisco, certain lines of development are clearly logical—1st, the Twin Peaks tunnel; 2d, joint development and usage by the City and Southern Pacific Company of the latter's old right-of-way through the Mission and Bernal Cut as a new southern outlet; also joint use of Ocean Shore right-of-way; 3d, four-track subway the full length of Market Street connecting with

the Twin Peaks tunnel; 4th, Mission subway branch connecting at Bernal Cut with the old S. P. right-of-way; another branch preferably out McAllister Street into the Western Addition and Richmond; upper Sunset to be served from the Market Street subway by the Mission-Sunset double-decked tunnel. Additional branches later may reach Harbor View through the Fillmore Street tunnel. Terminal facilities at the Ferry form a grave structural problem. The much superior convenience of subways and the peculiar necessity for such on Market Street render the consideration of an elevated line south of Mission Street of extremely doubtful utility, particularly in view of the modern tendency toward avoiding the obstruction and noise of elevateds in downtown streets. Until subways are required, the surface transit system should be developed to its fullest capacity.

Transit Policy and Procedure. Part I, dealing with growth and transit development, appropriately concludes with a plan of procedure by which an effective transit policy may be formulated and the results of such a plan carried to maturity as contemplated therein. The demands for a new water supply and the refusal of the voters to justify further bonding for revenue producing utilities place the City in no position to undertake the heavy investment in transit facilities now necessary. Thus, after having established the nucleus of a municipal system, it becomes powerless to effect the necessary expansion. At the same time, the Company is distinctly embarrassed in the raising of new capital for extensions by the limitation of its earning power to a very short franchise term through the restrictions imposed under the present Charter and the City's declared policy of municipal ownership. Approximately $8,000,000 authorized new capital is now impounded which might be released for extensions under more reasonable conditions of investment. Considering, in addition, that an unfunded debt of probably $27,000,000 will remain at maturities and with complete liquidation out of earnings practically impossible, there are no reasonable alternatives available to the Company except a radical reduction in capitalization, a resettlement franchise on the indeterminate profit-sharing basis, or both. Refinancing of the 4% U. R. R. bonds to a 5% basis would be of great assistance. The "Chicago plan," when perfected as outlined in Chapter 4, seems by far the most practical, providing for the purchase of the property by the City at any time upon an agreed basis, a safe return on underlying bonds practically guaranteed to the Company and a substantial share in the residual profits to the City. In effect, this plan when so perfected rapidly purges the investment of all intangible value during the first franchise period, and delivers the complete property with all

extensions into the hands of the City at the end of the second period at practically half price. Or, the City's share, if allowed to compound, will automatically recapture the entire property unaided within perhaps thirty years. Incidentally, the interests of Labor are conserved by the provision of a benefit reserve fund insuring employees against disability and also a bonus for meritorious service. Thus, through such a resettlement plan may be secured to San Francisco the three great essentials: (1) extensions as required; (2) continuous adequate service and equipment; (3) ultimate municipal ownership. But to accomplish these results, Charter revision along the lines of Amendment 34 is imperative. In the meantime, such improvements and regulations as regards equipment, routing, rehabilitation, and accounting as fall within the powers of the Board of Supervisors and possibility of acceptance by the Company under the present Charter require immediate execution. And pending the establishment of a Public Service Commission clothed with the City's executive and regulative powers over utilities, an advisory transit bureau should be temporarily established, with adequate powers for investigation and the perpetuation of essential records such as embodied herein.

PART II—SERVICE AND REROUTING

Rush Hour Traffic and Service. In the determination of service requirements, a complete cordon count was made intercepting *all* passengers outbound from the downtown district by way of the various throats of travel during the worst rush hour conditions, in order to obtain an actual measure of traffic so that service recommendations could be based strictly upon fact. The composite results for July, 1912, show a total outbound travel of 49,000 passengers between 5 and 6 p. m. Of the total city-bound travel, 42% was carried on Market and Mission Streets, and 11,700 passengers per hour on Market Street, the principal thoroughfare, with an average car headway of 27 seconds. Due to the delay and congestion at the Ferry loop and along Market Street, over half of the 15,000 trans-bay commuters walked to the Ferry. Comparing traffic with seating capacity affords a direct measure of service, and while some lines showed light loading, all of the Market and Mission lines showed very excessive loading, averaging 235 passengers aboard for every 100 seats furnished during the heaviest 15-minute period. For the usual "California" type prepay car, from 80 to 90 passengers can be accommodated comfortably, and 125 are only justifiable for single car loading in extreme emergencies. Therefore, the 65 new cars now on order will not suffice even for the present needs, if adequate standards of loading are imposed, as is only reasonable

with the high riding habit in San Francisco. But for a steady increase in schedule speed of cars—over 12% since 1905—conditions would now be worse. Although averaging about 8½ miles per hour throughout the city, congestion in the business district reduces the speed to as low as 2½ to 3 miles per hour, which indicates that local relief is imperative.

Relief of Lower Market Street. The absence of a north side thoroughfare parallel to Market Street unavoidably concentrates all this traffic into one thoroughfare; and with the capacity of Market Street and the Ferry terminal already reached, the only alternatives are minimizing the present causes of congestion and encouraging the greater use of streets south of Market Street. The elimination of unnecessary routes crossing Market Street and of many extra farside stops, with more uniform spacing of stops, will materially increase the operating speed. The practice of loading at both ends of the car during the rush hour has served to increase track capacity as well as loading speed. And with still better loading facilities, a further increase of about 2% in operating speed for every second saved per stop can be made. With traffic regulation making possible multiple car crossings, the existing safety stations, now quite unsuited to present needs, may be lengthened to provide for two-car or tandem berths. By so doing, delays due to crossing interference will be reduced nearly one-half, and operating speed thus increased. Radical improvements at the Ferry terminal are imperative to obtain necessary reservoir or car storage capacity and remove the throat congestion by the recession of the Sacramento Street corner. The use of four tracks in lower Market Street represents a most serious operating problem, requiring rigid inspection and traffic regulation. While the track capacity would probably accommodate 200 cars per hour, the present loop terminals are already practically up to their capacity; so that the majority of both Sutter and Geary Street cars must be turned back at Market Street until improved terminal facilities are provided.

Rerouting and Service Redistribution. As a result of traffic counts, by which the riding characteristics on each individual line in the city have been ascertained, certain improvements in routing have been developed both for the downtown or terminal loading district and for the outlying districts. From these counts it is apparent that service should be tapered off according to the demand (as in a system of water mains) by short-running or looping extra rush hour cars so as to distribute car mileage where most needed. Some of the present short-haul lines could be advantageously extended, circuitous routes for long-haul lines could be avoided, and

additional cross-town lines installed to relieve radial routes of this class of service. Local traffic is found to seriously inconvenience long-haul traffic, through delays due to extra stops and additional crowding. Therefore limited stop expresses, running on the least congested streets are desirable for outlying centers, and should encounter no objection when ample local service is provided by short-run routes. Because of the certain increase in traffic on Market Street, a diversion to Mission Street is inevitable; and while established routes are difficult to change, there can be no valid objection to diverting new routes or additional service, leaving the present Market Street service intact.†

At the date of the counts (July, 1912) about 65 additional trips were needed during the rush hour only. With the present equipment and routing, this number has increased to probably 84, requiring nearly the same number of cars, which may only be reduced by increased speed or by short-running. If the improved routing is carried out as recommended, the additional car mileage necessary may be reduced from 14.4 to 7.5% of the total for the rush hour. Midday service is largely a question of reasonable headway, and loading in excess of seating capacity becomes as unnecessary then as it is unavoidable during the rush hour. In a short-haul city, where walking is possible, a headway of not longer than 5 to 10 minutes (depending upon the locality) is necessary to develop traffic. It is equally important that cars from the various tributary branches be distributed along the trunk line with maximum regularity to avoid "bunching." The transfer system is liberal, and in fact too liberal for efficient operation, especially to prevent "loop riding." For the municipal system a complete plan of routes and extensions is presented, both with and without tunnels, and probably 300 cars would be necessary. For such a comprehensive system, many routes would be necessarily competitive, and even if transfer privileges could be obtained to and from United Railroads lines, the fare would have to be divided.

Location of Geary Street Terminus. In determining a proper location for the extension of the Geary Street Municipal line, a study of the topography indicated only two means of descent: *First,* by a long and dangerous 8% grade around Sutro Heights; and *Second,* by diversion south through Richmond. In view of the possibility of obtaining joint operating rights as far as Sutro Heights, the latter diversion was recommended in order to secure a better grade and the much needed development of valuable residence territory. This location also facilitates connection across the Park

†Some existing routes still approximate the routes of the old omnibus days—(See Historical Review).

and Sunset, and along the Great Highway, and paves the way for a future east-west trunk line direct from the business district via Turk and Balboa Streets.

PART III—IMPROVEMENTS IN ROLLING STOCK

Municipal Railway Cars. In preparing specifications for the new municipal railway equipment, it was deemed essential to combine the features of comfortable riding, reasonable capacity, quick loading, increased power and safety, all in a "California" type prepayment car. While the closed "box car" with continuous longitudinal seats provides maximum capacity for "strap-hangers," cross seats undoubtedly encourage traffic, and an effective combination of both has therefore been employed. In particular, the platform arrangement is such as to encourage rapid passenger movement, with the result that the average seconds per passenger is one-third less than for United Railroads platforms of equal length, and one-half less than on shorter platforms. Lift steps were provided, as essential for safe operation. By the use of remote control with all bulky electrical parts underneath, the car can be readily adapted for future operation in two-car units, tandem fashion. In the interest of conserving width of roadways already too narrow in San Francisco, a reduction in over-all car width from the present 9′ 2″ to the Chicago standard of 8′ 6″ has been effected through the more efficient use of materials, with a reduction of only one inch in net width of aisle. This standard permits track centers of 10′ 2″, with a "devil strip" of 20 inches between cars, thus gaining 18 inches for the roadway. By reducing the sidewalks from 15 ft. to 11 or 12 ft. width, the standard already adopted, it is possible to preserve the extremely necessary *free way between cars and vehicles* standing along the curb. While this change in existing track centers can only be made gradually during rehabilitation, it may be made on all extension work where the new car standards are applicable.

1912 United Railroads Car. In its new equipment the United Railroads has also adopted the "California" type prepayment car. However, the original design contemplated is at variance with the advanced principles embodied in the municipal car design, principally in the seating arrangement and width of car. While about half cross seats were provided for, the recommended seating plan was reversed by using them in the open instead of the closed section, upon the assumption that maximum capacity in the closed section was necessary during stormy weather. But with the simple provision of storm curtains the municipal car plan becomes preferable, providing maximum standing or *storage space in the open ends,*

where it is most useful for short-haul traffic. Tapered platforms were advised to provide for clearance of cars around curves when a suitable fender should have been perfected to make possible this very necessary factor in rapid operation. Other modifications of the original design were found desirable for a standard car, especially if designed for operation through the business district.

Improvements in Existing Rolling Stock. Expensive modifications in old rolling stock are hardly justifiable unless the saving for the remaining life reasonably exceeds the additional cost of new car bodies. Here, the principal objections have arisen from the application of the prepayment principle to platforms entirely unsuited for this method of fare collection, especially where a fare box is used. A large increase in platform capacity and loading speed is most necessary; in fact the largest of the San Francisco cars require more time per passenger to load even at *both ends* of the car than the standard Chicago car when loading at *one end* only—about one second per passenger. While lengthening the plaforms would be desirable in certain types, an increase of possibly 25% in loading speed may be obtained by rearrangement of the platform fixtures and the removal of the bulkhead to the interior of the car, thus forming a "California" type body. An improvement in seating plan similar to that of the municipal car could be advantageously made. Power brakes are necessary on all double-truck equipment, and replacing projecting steps by the folding type will minimize accidents. Certain non-prepay types such as the 1300 center entrance type may well be rebuilt for prepayment operation; for traffic counts show that the loss in these non-prepay types is excessive, over 90 passengers being missed on some lines of heavy travel, during one single outbound trip. Of the cable lines, Powell Street requires most urgent improvement, with double-ended cars as used on California or Clay Street. Obviously, the turn-table at Market Street exists as an unwarranted traffic obstruction in a street already too narrow. The extremely severe grades of the Union Street line suggests the need of a special type of car for hill service lines in San Francisco, of light construction, moderate size, and ample motor capacity.

PART IV—SUPPLEMENTAL IMPROVEMENTS IN CITY PLAN

Harbor View Tunnels. A comparison of available approach grades and the advantages to be gained by regrading streets affected, developed the fact that comparatively few routes are practicable. As Harbor View exists without a single low-level entrance from any direction, at least one tunnel is essential for

both railway and vehicle traffic, for which the approach grades should not exceed 4 per cent. Fillmore Street possesses the maximum advantages in this respect, although street widening at the portals will be necessary, and probably *arcading* of the building fronts in order to enlarge the present narrow roadway. In view of this grade limitation, the short tunnel underneath Fort Mason forms an indispensable link in the Belt line system for both freight and passenger travel, thus virtually extending The Embarcadero into Harbor View; and unless a low-level roadway is provided around Black Point, this tunnel should accommodate vehicle traffic also. Supplemental to the Stockton Street tunnel already under way, a tunnel under Broadway becomes particularly advantageous for car and light vehicle traffic, thus reaching both the business center and The Embarcadero. Being comparatively short, a single-bore arch with combined roadway is possible, whereas a double bore is essential for the Fillmore Street alignment. These tunnels are all needed for the proper development of the city as well as for the Exposition.

Rapid Transit Tunnel Under Twin Peaks. San Francisco is today bottled up as is no other large city, with only one direct outlet throat—through the Mission—other than those provided at great expense by private capital. And at least one-third of the city is practically unsettled as a result of the excessive time required for reaching the outlying districts. The Twin Peaks tunnel accomplishes not only the development of this unsettled acreage, but also a rapid transit route down the Peninsula. With this in mind, a miximum of 3% for long grades was established, which together with the necessity of reaching San Miguel Valley near Laguna Honda finally determined, out of six tunnel projects and twenty different combinations, the exact alignment recommended. As vehicle traffic is out of the question through so long a tunnel, this project resolved itself into a double-track bore suited for suburban trolley equipment and also high-speed multiple-unit trains for interurban service of the maximum size contemplated for future subway connection into Market Street. Although an ideal interurban terminal might be established near Valencia and Mission Streets, into which interurban trains could run directly from the Market Street bore, it is most essential, if the Market Street section is abandoned for the present, that the main hill section conform to the recommended contour extension of Market Street and emerge from subgrade at Eureka or Castro Streets, so that a future direct connection with this Market Street subway could be made. The straight extension of Market Street is impracticable, but the contour extension provides not only the necessary tunnel alignment, but also an independ-

ent vehicle route around Twin Peaks. Eventually, a cross-town transfer connection at Laguna Honda station will be desirable, and a "reservoir station" in Eureka Valley designed for connection with a supplemental Mission-Sunset tunnel under Buena Vista Heights By building this latter double-decked, surface vehicle traffic can be accommodated on the surface and cars beneath, connecting either at subgrade with the Market Street subway, or by inclines to the surface tracks. By these projects the entire ocean beach will be brought within 30 minutes local time from the business center, and San Mateo possibly within 30 minutes from the city by high-speed interurban trains.

Improvements in City Plan. Supplemental to the execution of the plans proposed herein for extensions and rerouting, a number of minor improvements in city plan will become distinctly useful, and some almost essential. Only such minor projects as street extensions and regrades, cuts and fills, widening of roadways, etc., are here dealt with, rather than the major products such as recommended in the Burnham plan. It is essential that with existing streets a wider roadway be provided for permitting at least one line of *moving* vehicles between cars and other vehicles *standing* along the curb. In this regard automobile stands at Union Square are obviously necessary. The extension of Van Ness Avenue to Mission Street, and the connection and improvement of streets in the "Hub" district of the Mission are favored; also a very short tunnel connection to permit a low-grade line into Noe Valley. A Kearny Street tunnel under Telegraph Hill is considered a practicable location if the money can be raised. A most important subject is the Bernal Cut, by the improvement of which, a new rapid transit route to the County line is rendered available through the co-operation of the City and the Southern Pacific railroad in the joint improvement of the latter's old right-of-way. The contour plan of street extension is urgently recommended not only for Market Street west, but also for all new streets in territory unsubdivided where heavy grades are encountered.

Terminal Improvements on the Harbor Front. A study of the congestion on lower Market Street indicates the great need of increased terminal facilities at the Ferry, not only for present but for future travel. Although the special nature of ferry service requires *reservoir* capacity to serve ferry-boat traffic to any reasonable degree, none is now available. The loops, while able to accommodate present Market Street traffic, have practically no reserve for additional traffic from the Geary and Sutter Street lines to be delivered from the outer tracks. This necessitates the diversion of car traffic to the few stub terminals available north and south of Market Street.

Not only are additional loops necessary now for north and south side cars, but also an additional loop or stubs for Market Street traffic. But the latter can only be temporary, and the final solution appears to be found in an elongated loop reaching the *upper floor* of the Ferry terminal, leaving the ground floor for vehicles and north-south side traffic. Eventual enlargement of the ferry buildings, extending the loading frontage in both directions, will make this imperative. Such a comprehensive plan absolutely requires the recession of the irregular building line of The Embarcadero, so that the inclines may be made off of Market Street. And by co-operation of City and State an *equalization of areas* east and west of the proposed frontage line may be effected without loss of property. In any event, the recession of the protruding Sacramento Street corner is urgent. An alternative plan somewhat less ambitious might suffice for some years by elevating two tracks in Market Street east of Spear Street, retaining the present surface loops for traffic on the outer tracks only, thus avoiding the widening of Market Street. For Ferry terminal service, lay-over cars are essential, with fixed car berths, electric indicating and dispatching signal system, segregation of inbound and outbound passenger flow, ticket booth collection, and loading at both ends of the car as equally necessary requirements. Much of the present congestion is due to indecision of passengers regarding stops and routes, and police traffic regulation would be of immediate assistance.

PART V—ANALYSIS OF RAILWAY OPERATION AND RECORDS

Financial and Operating Records, United Railroads. Apart from questions of intercorporate financing and integrity of sinking funds and surplus (which latter clearly fall within the scope of State rather than City supervision) an exhaustive analysis of records for the past decade formed an important phase of this investigation.

The property is found to be inherently stable from an operating standpoint, to have exceptionally high earning capacity even under the high cost of operation in San Francisco, to be efficiently maintained as regards equipment, but low in maintenance of way and structures, and to enjoy a high average fare with only moderate dilution from transfers. Wages are higher than in other large cities, but the tax burden is comparatively light, and the City's share inconsiderable. Since the consolidation, the drain upon net earnings due to increased fixed charges has made dividends upon preferred or common stock practically impossible, at the same time assigning

proper cash reserves to depreciation, renewals and sinking fund for the amortization of outstanding liabilities and to all appearances, approximately $27,000,000 unfunded debt will remain unsatisfied at maturities. To the former liberal dividend policy and lack of reserves may be ascribed much of the financial embarrassment following the fire, although the fire was found to have occasioned only about one-fourth the loss in earnings caused by the strike, and comparatively little uninsured loss in property. With reasonable reserves, the property is now able to earn around 7% on the present bonded debt of $40,000,000. Owing to Charter restrictions, limitation of franchise term, and market price of present securities, about $8,000,000 authorized securities are now unavailable for extensions and betterments, so that a radical change in plan is necessary to enable the Company to raise new capital at reasonable rates for extensions.

Owing to the high density and rapid increase in traffic, unusually high earnings per unit of operating equipment are shown. And although the comparatively small seasonal variation in traffic makes possible minimum investment and high relative usage of equipment for the same service as compared with eastern cities, a shortage of equipment is indicated by these records which is reflected in the excessive loading found by actual traffic counts. From the analysis of income, it appears unquestionable that a considerable increase in service as prescribed herein may be readily met without unreasonable diminution of net income.

Condition of Property. By means of a personal inspection, the condition and adequacy of track, equipment and structures were determined. According to a reasonable standard, it appears that about 70 miles of single track and 23 miles of paving (along good track) represents the magnitude of rehabilitation work that must be undertaken in the near future, of which over half is urgent. Of the equipment, 40% is either inadequate for downtown service or requires rebuilding into modern prepayment cars. The platform capacity of most of the prepayment equipment is inadequate for the traffic encountered. A good record of improved maintenance of equipment appears during the last three or four years, but track maintenance has been seriously neglected. While car shop facilities are excellent, the fire risk in practically all car houses is serious. As a result of the transfer of power generation to an affiliated company (the Sierra & San Francisco Power Company) the conditions of power supply have greatly improved within the last three years, and this with a moderate power rate. The equipment of the Presidio & Ferries line is totally inadequate

as regards motor capacity, but the track having been recently rebuilt is in good condition, which can also be said of the California Street Cable Railway.

PART VI—FRANCHISES AND LEGAL MATTERS

Charter Amendment No. 34. Recognizing the inhibition against private capital under present Charter provisions and the inability of the City to either purchase its street railways or provide funds for a comprehensive municipal system, the formulation of a broad enabling act was made necessary under which the City could grant new and resettlement franchises, subject always to the will of the people. With certain safeguards against former defects, new capital could then be raised under proper conditions to meet the growth of the city. The indeterminate form of franchise was adopted, subject to the maximum term under State law—25 years—but with conditions properly protecting the integrity of the *underlying investment* up to the time of recapture by the City through purchase or automatic amortization of debt. While incorporating all of the desirable features of the Chicago profit-sharing franchise, this plan distinctly improved thereon by enforcing decapitalization—1st, of all intangible values; and 2nd, of half of the tangible property. The present Charter wage scale, impossible under American railway conditions of flat 5-cent fare, was necessarily modified, but a substantial profit-share was practically guaranteed to the City, by which the City could automatically recapture the property. And the impossible condition that private capital should retire its entire investment within the short period of 25 years was rectified by the recognition of a continuing investment, thus protecting *new* capital. By thus strengthening the basic financial conditions, private investment would be encouraged, municipal ownership would become a practical possibility instead of a theory, and continuous development and adequate service would be insured without loss of essential rights now held by the electors.

General Franchise Ordinance. The fundamental principles contemplated in this modification of the City's franchise policy consist largely in codifying its regulative powers in the form of a general franchise ordinance, detailed in sufficient particulars to govern future grants, and thus give definite expression to municipal regulation and supervision of utilities. Adequate continuous up-keep of property is safe-guarded by the reservation of a proper proportion of gross income for maintenance and depreciation; construction of extensions is insured by the guaranteeing of underlying investment; unreasonable demands for expansion or ser-

vice are curbed by the resulting dilution of net earnings and diminution of the profit-share; sinking funds are established for the amortization of capital investment; unscrupulous financial raids on the property are prevented by a bonus in addition to the purchase price; practical regulation and supervision is exercised through a competent and non-political commission clothed with administrative powers now held by the Board of Supervisors; private capital is accorded a reasonable return and an opportunity to reclaim its investment without ultimate loss; and unified operation of the entire traction system is made possible, irrespective of ownership, with a single fare and universal transfers.

Present Franchise Status. An effort to establish the validity and ultimate earning power of existing franchises developed the fact that grave uncertainties exist, determinable only by legal process of court decision. As a result of successive consolidations, the original intent and conditions of many franchises, some of which are very important, have been departed from without official consent of the City, whether through lax supervision or otherwise, thus introducing questionable legal status. In the case of Market Street Railways, uncertain *definition of term* in the amending order results in a difference of $15,000,000 in earning power. Owing to differing franchise periods, the present traction system, two-thirds of which expires in 1929, will be left in a fragmentary condition, entirely unsuited to effective operation. A number of important lines are operating either without franchise or under very questionable grants. As a result of the radical migration of population since the fire, some franchises heretofore most valuable have been seriously reduced in importance, so as to necessitate ineffective routing for holding these franchises. The conditions of the present Charter render new franchises for extensions practically prohibitive. All these conditions conspire to make it extremely desirable to establish the status of these franchises, to equalize their terms, and to clear the city's streets of all unused and ineffective franchises.

Computation of Taxable Receipts. In carrying out the tax provisions of existing franchises, the "duplicate or multiple service" resulting from the routing of more than one line over the same track has introduced serious complications and expense of audit in determining this tax on gross receipts. While the City claims full percentage upon all receipts from duplicate service routes, the Company considers one line as fulfilling the conditions of this franchise tax, and year by year the matter has been compromised arbitrarily. But an analysis of this question, based upon the conception of a usage tax, leads to the conclusion that the proportional tax upon "multiple service" should be based upon such proportional

usage. While passenger mileage would theoretically prove a more accurate basis, it is recommended that the distribution should be made upon a *car mileage basis* as the most tangible evidence of service or usage, *i. e.,* that the taxable receipts of a given section of track bear the same relation to the total receipts of all routes operating thereon as the actual car mileage over that section bears to the total car mileage. But it is also recommended that this troublesome matter be simplified by an *equalization* of this percentage tax over the entire system. This usage tax now averages little more than one-half per cent of the passenger earnings, owing to the large amount of exempt mileage, and even this has decreased since the last determination.

End of General Review.

PART I

GENERAL PROGRAM

CHAPTER 1

PRESENT TRANSPORTATION CONDITIONS*

In this introductory chapter to the report proper, no attempt is made to present or discuss detailed facts and figures to a finality, but simply to define in general terms the scope of the transportation problem now confronting the City, each phase of which is analyzed in detail in succeeding chapters. In spite of some unavoidable repetition it is necessary that the subject should be thus broadly surveyed at the outset in order to forestall the formation of incorrect opinions which might give undue weight to certain less important phases of the subject.

Growth of the District. Within the short space of sixty years San Francisco has not only developed its utilities as have other American cities within the same period, but most important, it has developed its City, extended its water front, reclaimed its sand dunes, settled its hillsides, and is now face to face with the serious problem of forcing its utilities to keep pace with this rapid municipal development. And with the utmost certainty of tremendous expansion under the impetus of the Panama Canal, the City is just beginning to realize the difficulty of coping with this expansion in the face of competition of neighboring and other coast cities, which have been extremely active within the past few years in perfecting their facilities for handling the expected commerce.

During the past decade a much higher annual rate of growth has taken place in the City than in any other period of its previous history. Commerce has increased proportionately, and the banking year of 1906 actually showed an increase in clearings, even with the enormous drop following the catastrophe of that year.

The utilities have advanced rapidly in earning capacity, more especially railways. But for the past decade, unfortunately, there has been practically no expansion. On the contrary, a tendency to concentrate and to increase earnings has manifested itself. At least one-third of the City is practically *unpopulated* through lack of necessary utility service—railway and water, while it is a fact that the southerly districts of this City embrace residential development sites, exceeding in natural advantages anything in the District, especially in convenience of transit when proper facilities

*Formerly Preliminary Report No. 9, submitted Sept. 18, 1912.

are provided. That these sites remain undeveloped furnishes the most direct proof of the lack of proper service.

As small as it is, the City has not only not utilized its own territory, but contemplates expansion down the Peninsula and across the Bay. Unquestionably, the City should not only develop its own territory as rapidly as possible, but also attempt to evolve, in conjunction with adjacent cities, some form of Metropolitan District Control by means of which the normal and adequate development of utilities and other enterprises vital to its life, may be effected. If the prevailing rate of growth continues, San Francisco in 1930 will probably be the center of a District community of 1,366,000 persons, with 722,000 persons within the City proper, from which nearly $20,000,000 per year will be paid into the coffers of the railway company alone.

With the recently added financial burdens of water system acquisitions, it is hardly to be expected that the City is in a position to immediately acquire the entire railway system, especially in view of the fact that franchise equities exist, which will enhance the purchase price until such franchises have expired.

A practicable means must therefore be found to insure certain immediate extensions and an adequate program for the future, if San Francisco intends to keep pace with the high rate of growth which is characteristic of the Coast cities. It has reached a point in development where increased concentration will work to its injury,† not because of too great density of population, but because of the competition from the attractive districts surrounding it.

Metropolitan District. If the existing municipal boundaries are obliterated from the map of most large cities, it will be found that the broad movements of population are usually quite independent of them, and that radiating lines of development extend in all directions as far as the topography of the country will permit, until the limitation of *time* or *cost* of transportation is reached.

This limitation finds its best expression in the *30-minute time-zone*, (Plate 3) which generally represents the limit of thickly settled sections for the reason that the average business man cannot afford to spend more time in transit. If settlement is found beyond this 30-minute time zone, it occurs that peculiar attractions in climate and location, or low cost of land and fares thereto, compensate for the extra time required.

The time-zone map of San Francisco reveals the peculiar situation that although the greater portion of its area could be reached

†This is manifested by the notable tendency toward apartment buildings rather than homes in the close-in districts of the city.

within 30 minutes by improved methods of transportation, yet at the present time only about *half* of its area has been developed. On the other hand, the daily migration of business population across the Bay presents no parallel in this country, with the exception of New York City. This is all the more astonishing when it is con-considered that *none of the trans-bay commuters are able to reach land within 30 minutes* from the business center* of San Francisco, 20 or 30 minutes additional being required for these commuters to reach their homes in Oakland, Alameda, Berkeley, and the Marin County suburban towns.

The one really logical development—by steam road down the Peninsula—shows a volume of traffic which is relatively inconsiderable, and, moreover, has remained practically stationary in spite of the fact that millions have been spent in the construction of an improved rail entrance into the city by tunneling through the various ridges interposed.

That this extremely unbalanced development has occurred in spite of more rapid Peninsula service, shows that it is largely due to the high cost of transportation. This is apparent from a comparative study of the *time-zone* and *rate-zone* (Plate 4) maps appended. While a five-cent commuter fare reaches the north of Berkeley, for the same *time-distance* down the Peninsula, a fare of 13⅓c† is charged. This disparity of commuter rates is directly responsible, in my judgment, for the peculiarly erratic development of San Francisco, automatically reserving the attractive foothills of the Peninsula Coast Range for the rich land owner.

However, one fortunate result has occurred. Oakland has reached a state in its development where it is rapidly becoming practically a self-supported and self-centered city. That the rapid trans-bay suburban expansion of the past few years cannot continue in the future is shown by the fact that the probable limit of quick transit has been reached under the present system of electric train service through city streets; and as the fare could not conceivably be any lower, the filling up of the suburbs now laid out will tend to determine the future limits of trans-bay settlement.

San Francisco, on the other hand, will always continue to be the business and social center; and instead of attempting to curtail trans-bay development, it should turn to the development of the immense acreage within its own borders and down the Peninsula. This will undoubtedly come through improved transportation and as a reflex of the Panama Canal, if the opportunities are taken advantage of.

*Third and Market Streets.

†This time-distance is an average corresponding to Redwood Station, midway between the limits of local time to Beresford (fare 11.68 cents) and express to Palo Alto (fare 15.83 cents).

A most essential factor is that *transportation must precede settlement* of any territory. Any policy which attempts to reverse this process will certainly lead to utter failure to develop the resources of the city to the fullest extent.

Riding Habit. That the people of San Francisco are responsive to improved transportation is shown by the fact that the riding habit, as expressed in earnings per capita from transportation, is here the highest of any city in the country, and almost twice as high as the average city, even exceeding Los Angeles in this respect. This is due very largely to the prevailing liberality of its people, but also to the fact that the earnings from transportation are partly made up from daily business population, while the census is based upon sleeping population. And inasmuch as the daily trans-bay commuter traffic is fully 23 per cent of the population of San Francisco, this results in earnings per capita as high as $18 to $20, as against $10 and $12 for the average American city of moderate size. This fact constitutes the one prime source of optimism regarding the City's future development. *The earning capacity is available.* It only remains to develop a *transit policy* commensurate to the opportunity, and to execute this policy with courage and dispatch.

Topography. By a peculiar combination of topography, San Francisco is virtually shut in on all four sides, with the exception of a narrow pass down the Mission valley around the base of the San Bruno Range. But the possession of perhaps the finest harbor in the world is more than compensation, and the City should consider itself fortunate in not having more impassable barriers. Within the city limits numerous ridges and hills interpose obstacles which not only render transportation expensive, but which inevitably result in the comparative isolation of various districts, such as Hayes Valley, Noe Valley, Eureka Valley, Pope Valley, Happy Valley, Harbor View, Visitacion Valley, San Miguel Valley, etc. Up to the present time, this isolation has had one unfortunate tendency, viz.: to disorganize the City into numerous small, self-centered communities, whose interests have become so diverse (although, in reality, identical) as to constitute an almost insuperable barrier to wholesome municipal progress. The remedy for this is *quick and convenient intercommunication,* which can hardly be achieved until these barriers are removed by means of tunnels through the intervening hills.

At the present time the site of the Panama-Pacific Exposition in Harbor View is comparatively isolated in this manner, and will remain so until steps are taken for adequate transit facilities. This can best be done by tunnels, as the approach grades are too steep

for any method of traction except the cable system, the capacity of which is extremely limited as compared with electric traction.

City Plan. Several factors contributing very greatly to the difficulties in providing proper transportation are directly traceable to the city plan of San Francisco:

1. The unfortunate rectangular street layout, completely ignoring the contours or hillside plan, as recommended by D. H. Burnham and others.

2. The angular position of the streets north of Market Street permitting no supplemental thoroughfares parallel to Market Street to which some of the traffic thereon may be conveniently diverted.

3. Roadways north of Market Street are just too narrow to permit efficient vehicle traffic in addition to street cars; *i. e.,* two lines of vehicles in each direction.

Finally, the use of 25-foot lots, which encourages concentration and ultimate congestion by the use of very narrow buildings.

It is most unfortunate, though readily understood, that the financial condition of the community immediately after the disaster of 1906 did not permit of some improvements in the City Plan being carried out which would serve to rectify some of these blunders in the original plan, and particularly in the way of diagonal supplemental thoroughfares by which the hills could be avoided and short-cuts found for more convenient transit; but it is still not too late to consider some of these enterprises, and this should be done before the property values have risen to prohibitive figures.

And it is recommended that the City do these things in the interest of rapid transit, irrespective of the identity of private or municipal traction interests.

Climatic Conditions. The prevalence of winds and fog in the Richmond and Sunset districts is often cited as the reason for the delayed development of these sections. I believe this to be largely a fallacy, and that the real reason is the absence of adequate service from utilities, particularly railway and water. A recent report on water service in the outlying districts by your City Engineer confirms this conclusion. Such utilities must precede settlement.

There are numerous sections of the southwest district* that are admirably sheltered from the prevailing winds and fog from

*As a matter of fact, even the anticipated building of the Market Street extension tunnel has caused considerable activity in the development of some of these desirable areas south of the Twin Peaks ridge.

the ocean, so that no good reason exists for their lack of development. Practically all of the down-Peninsula acreage is thus sheltered and needs only *cheap and rapid* transportation to bring about a development similar to that across the Bay.

United States Weather Bureau reports for the past 41 years indicate the following normal conditions prevailing in San Francisco:

Seasonal temperature range	50° to 61° Fahrenheit;
Mean annual temperature	55.2° "
Relative humidity	75%;
Fair	158 days;
Fair and cloudy	295 "
Actual precipitation	70 "
Average prevailing sea breeze	9.7 miles per hour.

During the working day (7 a. m. to 7 p. m.) it is found that the temperature rises to a mean of 56° Fahrenheit, accompanied by a rise in wind velocity and decrease in humidity, these factors combining to produce ideal working conditions. In the interior, the reverse is usually true with regard to wind velocity. These facts need only comparison with conditions of Eastern cities to show that from a climatic standpoint, some San Franciscans find fault with their chief civic asset.

Service and Rehabilitation. Unlike all other utilities, there exists in the street railway business an exceedingly intimate point of contact between the corporation and the patron—the street car—the successful operation of which involves an additional human element, and a very important one—the trainmen. In the light and power business, no human element enters between producer and consumer. In the telephone, only a distant exchange enters. In the railway, the consumer is daily brought into most intimate contact with the Corporation, its physical property, and its personality, through its representatives, the carmen. Service is the reflex of these points of contact, and good or poor, according as the integrity of the physical property is maintained, and as the discipline of the trainmen is rigidly enforced.

The former is indicated principally in the condition of the cars and roadbed, which in turn reflects either the financial condition of the property, or the desire of its operators for dividends. This condition of the operating property has been determined by a detailed examination of plant, rolling stock and roadbed, which reveals the fact that a large amount of rehabilitation work still remains to be done in various parts of the city, although the extensive reconstruction following the disaster of 1906 is responsible for the

electric track in many parts of the city being in very good condition at the present time. And although much of the rolling stock is in good condition, a considerable portion will have to be retired at an early date, either entirely or confined to the outlying districts, only the largest and most modern equipment being permitted on the down-town streets. The introduction of the prepayment principal has brought about the necessity of certain changes in the more modern equipment now in operation, especially in platform capacity, so that even with the addition of the new equipment contemplated, much rehabilitation and improvement work will have to be carried out.

To determine what service standards exist in San Francisco, a complete traffic count of the entire transit system has been made for a composite normal working day, together with supplemental observations upon street and pedestrian traffic, and not only does this count cover the main traffic arteries of the entire city, but also involves the riding habits of each individual line or route, the location of zones of maximum travel, and the average passenger ride of the various lines.

The results of these traffic counts indicate a wide variation in the general character of service on the individual routes, some of which appear to be favored, others neglected, both with respect to frequency of headway and type of equipment, resulting in excessive car loading on certain routes, all of which can only be remedied by additional equipment and re-routing of cars, with such service redistribution as the individual route counts show to be necessary, thus saving considerable useless car mileage for operation *when and where most needed,* as determined by the riding habit of passengers. Car congestion in lower Market Street and the delays in running schedule resulting therefrom can be improved very materially, so as to conserve the full capacity of this important thoroughfare, and similar methods of relief may be applied to other parts of the system with immediate results. Recommendations in detail are made in Chapter 7.

Although the Company is operating practically up to its published schedule, even the addition of the 65 new cars ordered and the few being reconstructed at the Company's shops would barely have sufficed to realize a proper standard of rush hour service, at the time of observation, July, 1912, irrespective of the future demands of the Panama-Pacific Exposition traffic.

An exceedingly liberal transfer system is in effect, in fact so liberal as to permit of extensive "loop riding" for a single fare, and the City should co-operative in any feasible plan to reduce loop riding without considering this as curtailment of the franchise

privilege, for every return fare thus stolen by a dishonest patron *has to be paid for by the honest patron.*

One important fact brought out by the examination is that the present traffic of electric lines is far beyond the maximum possible capacity of any cable system.

The above service conditions, when viewed in the light of events of 1906 and 1907, need not appear so unfortunate as they might do otherwise if a *certainty of immediate relief* were assured. Re-routing will involve some readjustment of the labor schedule, as any increased rush hour service as compared with day service will mean an increase in short-time trainmen or "trippers." Increased investment will be necessitated to provide this rush hour service desired; and all these factors focus in the corporate income account and the operating ratio. It is thoroughly impracticable for a regulative body to proceed blindly with the ordering of service or equipment, without determining whether the income will warrant such an increase, for it must be remembered that the street railway is the only utility operating with a fixed maximum income unit—5 cents—which provides no flexibility whatever in the adjustment of operations to returns as in other utilities; and *necessitates the cutting of the operating cloth to fit the financial pattern.* It is therefore extremely necessary that any settlement or regulation be based upon the fundamental fact as determined by the income account which the Company should cheerfully furnish.

Transit Developments. To carry out the necessary development of railway extensions, several distinct plans have been evolved for the present and future, and from the several standpoints of a private, a municipal, and an ultimately unified system. On the theory of competition, many extensions to the present nucleus of a municipal system could be devised, but which would require duplication of capital investment. However, from an economic standpoint, duplication of investment is improper and unjustifiable; so that the municipal system may find its most logical expansion along lines of *development rather than competition.* This is the fundamental idea of the development of properties inter-related from a capital standpoint, which ultimately must gravitate to the ideal situation—*unification—one city, one fare, universal transfers, unified operation, minimum investment.*

At the present time, San Francisco absolutely requires a large increase in mileage, but the fact exists that under the conditions that have been imposed (in the hope of immediate results, no doubt), *not one foot of extensions may be expected from private capital.* Yet some of these extensions are most pressing, such as additional facilities to the Exposition site in Harbor View.

Legal Matters. The legal status of the railway utility in San Francisco is clear. With a franchise life of about 15 to 20 years, and the corporation in possession of main thoroughfares and the lines of maximum traffic density, it will be possible to continue operation to the end of the franchise term with every assurance of reaping maximum profit,—that is, the "cream," leaving the "skimmed milk" for municipal enterprise.

The present franchise situation is extremely complicated by overlapping grants, by non-conformity of franchise conditions, by the lack of official cancellation of portions of unused franchises, etc. Naturally, having acquired numerous competing franchises, the Corporation has abandoned many parts in the interests of a more coherent and efficient operating system. And it appears to be a fact that these lapses were recognized by the municipal government without invalidating the remaining rights, for its officials have apparently given a left-handed consent by taking no action, and until late years, not even seeing to it that the Corporation lived up to the terms of its various franchises. In such cases of lax municipal control, it is often a difficult and tedious process for municipalities to reclaim their rights and deferred revenues thereunder. Therefore, it seems more desirable for the City to straighten out its present affairs and to provide for the future than to endeavor to extract questionable compensation from the uncertainty of the past. And an attempt might very well be made at this time to clarify the franchise situation and relieve the city streets of present questionable franchise encumbrances by a new blanket agreement in the form of a co-operative contract franchise.

Under the present charter, no purchase clause is in effect giving the City the right to buy the existing property at any time, and so long as the Corporation conducts its financial affairs in a reasonable manner—that is, without forcing its rate of return to the utmost limit—it stands intrenched, except in the regulation of service. As the City cannot logically impose a higher standard of service upon the Corporation than upon its own lines, the Corporation need have little fear from the City's competition, because of the higher operating expenses imposed by the City Charter and the higher investment that has prevailed.

In the new City Charter conditions are imposed which practically debar private capital from investment in San Francisco, whether the point of view of the capitalist is reasonable or not. Two facts stand out prominently:

First—Private capital must be given an opportunity to secure its investment by reclaiming it during a reasonable term; and

Second—A rate of return must be guaranteed that will be sufficiently attractive under average conditions of the financial market, commensurate with the risk involved. That risk is involved even in so apparently insured an investment as street railways is evidenced by the uncertain future of traction properties throughout the entire country.

These Charter provisions and the underlying theory with respect to private capital will have to be modified, or else it is incumbent upon the City to buy its utilities at once at a considerable premium. It cannot force private capital to invest under conditions considered unprofitable. At the same time, there are extensions which cannot be made by the City, but ought to be made by the Corporation, and vice versa. And it is believed that the Corporation would then cheerfully extend into non-competitive territory, even in the face of the City's avowed intention of forcing out private capital. Certain steps could therefore well be taken at the present time to remedy these conditions:

First—The Charter may be amended so as to make private investment possible.

Second—Present corporate franchises may be merged on some equitable basis of equalization with extension franchises desired.

Third—Duplication of investment may be avoided by non-competitive extensions, with the object of ultimate unification of the entire property at the lowest possible investment cost.

Without a real solution of this maior problem, all of the minor activities proposed in this report and by other organized bodies having the interests of the City at heart will be largely frustrated The question of a sane, reasonable, and workable franchise agreement between the City and the United Railroads is the *first great matter to be settled,* to which all others are subordinate, and no time should be lost in formulating such a plan.

It is necessary to say here that the evolution of this much-desired plan will not be furthered by the use of old arguments and the useless discussion of former abuses and unfortunate occurrences in the history of civic and traction development, by both sides of the controversy, to force concessions. *Progress is not retroactive.* Conditions exist today as they are, without reference to the past, and a solution must be found for *today and tomorrow,* rather than yesterday. Consequently, the application of radical restraints to the present situation will utterly defeat the purpose of the sober and determined citizens of this City to record a fresh page in the history of their civic development.

Regulation and Supervision. The most hopeful fact in relation to this proposed agreement is that the California municipalities

have unquestioned jurisdiction over their public utilities in a regulative or supervisory capacity—that is, over rates, service and equipment, and to some degree over extensions. When it is considered that some of the older Eastern cities have virtually lost control of their streets and through gross misjudgment have awarded franchises running as high as 999 years without compensation, with standards of service on the lowest plane, with the corporations on the verge of bankruptcy by reason of the excessive burden of securities issued upon these perpetual franchises, with the riding habit curtailed by this poor service, and with little hope of new capital for rehabilitation and extensions under the prevailing financial plan, *the position of San Francisco is enviable, indeed.* The power lies within its hands to evolve a magnificent transportation system under the impetus of high earning capacity. With sane regulation and the recognition of the rights of private capital, it will be possible for the City to develop along logical lines, both its municipal and its private systems with a certainty of ultimate unification. It goes without saying that such regulation must be practical and not punitive, and one of the first requisites is for the municipal legislative body to create and maintain a commission of technically trained men to carry out this highly technical business and relieve the legislative body from the consideration of the innumerable details of such a business. The time and training of a legislator does not permit him to engage in the operation of a public utility.

Such a commission must have complete and unquestioned authority over all operating, construction and financial matters, except the purely legislative function of granting franchises. There is no middle ground of *divided responsibility.* And if conditions with regard to term of office, compensation and technical training cannot be made so as to create a commission of adequate ability and of absolutely independent political connection, then a simple bureau or branch of the City government would be preferable, having advisory and investigative powers only. But the former would be more desirable, and is directly in line with the establishment of the First and Second District Commissions of New York, having respective jurisdictions over the City and State of New York.

Conclusions. Summarizing, the foregoing may best be epitomized in the form of a development program stated very briefly in the introduction to the report, to be followed out by both City and Company in effecting a solution of the present difficulties. The City has unquestionably been greatly handicapped in its development by the failure of the transit companies to keep pace with its rapid rise in civic standards, as well as in magnitude. But the problems of the future have not been fully appreciated in the past, and as a

result of lax municipal control, abuses have crept in, which should now be remedied.

On the other hand, the present corporation is in a measure struggling with an inheritance of financial evils whose oppressive nature was only brought to light by the disastrous fire and strike. As a result of this loss, which could hardly have been anticipated, it finds itself in straightened finances, unable to meet the higher standards of service, and with credit contracted by reason of the City's expressed determination to effect complete municipal ownership of its utilities. Additional investment must have security of return, and with impossible conditions imposed, such investment is therefore automatically nullified.

It must be apparent that until the City is able to purchase its utilities at a fair price, it must depend upon them for service. Consequently the interests of City and Corporation are most intimately identified in the matter of transportation, and it is upon this premise that the improvement program of Chapter 4 is suggested.

CHAPTER 2

GROWTH OF EARNINGS AND INVESTMENT IN TRANSIT FACILITIES*

Estimate of Future Growth in Population
Prediction of Future Earnings and Extensions
Record of Business and Railway Growth
Railway Investment and Relative Purchasing Power of City

To intelligently plan for the development of a comprehensive transit system, and especially for the ultimate unification of utilities under municipal control, it is essential: (a) to review transit operations up to the present time, in order to ascertain whether growth has kept pace with necessities; and (b) to estimate future conditions at least to 1930, which year will mark an epoch in the City's career, due to the expiration of about two-thirds of the present franchises. From this may then be determined what is to be expected from the Company in the case of continued private ownership, or what the financial burden upon the City will be in the event of municipal ownership; for only by this intensive examination may the operating and financial blunders of the past be avoided, both now and in the future. In this chapter is presented a prediction based upon careful scientific analysis of the future growth of traffic requirements, transit earnings and investment, in comparison with the estimated bonding power of the City under present charter provisions.

CONCLUSIONS AND RECOMMENDATIONS

1. An analysis of growth shows that San Francisco is now growing faster than during the five years before the fire, and at a rate of increase about 145,000 per decade. The real growth of the city, excluding the effect of the fire, has been at the rate of 54% for the last decade as against 22% shown by the census. At the present time the city contains about 450,000 people. This population, on the conservative basis assumed, should double in 26 years, and should reach 1,000,000 people in 1945 although it may far exceed this.

2. San Francisco and the commuter district now has a population of 730,000 people, and has increased 48% in the last decade. This population should double in 23 years, reach 1,000,000 in 1919, and 2,000,000 in 1945.

*Formerly Preliminary Report No. 19, Submitted Jan. 2, 1913.

3. In spite of this rapid growth, other large cities of the Pacific Coast are growing on the average at a rate probably 50% faster than San Francisco.

4. As a result of the fire, San Francisco lost 100,000 people permanently. The trans-bay cities gained in population by an amount practically equal to San Francisco's loss. But traffic statistics show that Oakland and its surrounding communities are becoming self-supporting to such an extent that the exodus from San Francisco has practically ceased, and that Oakland will go forward at a normal rate as a supplementary community.

5. One beneficial result of the fire was a general exodus of residents from the congested "inner city" to the suburbs, amounting to 66,000 people in the last census period. This has necessarily increased railway earnings and should therefore have made possible correspondingly improved service. The present distribution of population within the 30-minute time zone is unusually uniform, except Chinatown and Japtown. The outlying distribution indicates that people will live where proper streets and car service facilities are provided.

6. The growth and interchange of population within the district shows that the broader movements of population absolutely disregard municipal boundaries. The idea of a Metropolitan District Control for the development and regulation of utilities and industries is therefore of unusual necessity for San Francisco and the Bay cities.

7. A review of industrial growth shows that the period of great activity occurring just before the fire was practically recovered by 1910, and that commercial operations now generally exceed those of 1905. The fact that bank clearings suffered no perceptible depression during the disastrous year of the fire indicates the sustaining power of the financial credit of the community.

8. Manufacturing within the Industrial District has alone failed to keep pace with the population within the last decade. In this respect the Bay cities have gained directly from San Francisco's heavy loss. The evident need for a more united Industrial District points unmistakably to the practical value of the Metropolitan District Control idea already suggested.

9. An analysis of railway earnings shows that they are increasing in proportion to the square of the population—that is, when the population doubles, earnings quadruple. United Railroads earnings alone should double in the next 13½ years—*i. e.*, should reach $16,000,000 by 1924-5—and should quadruple by 1942. Earnings per capita are now the highest in the country—$20 per capita for all companies.

10. In extension of track mileage, San Francisco is at least six years behind the necessities of the growth in population. Trackage should extend at least as fast as the population, if not faster. The total track mileage is now about the same as before the fire, due to abandonments, and the last 15 years shows a slower growth than at any period of the city's history. This delayed construction must now be made up.

11. The present necessities for track extension require about 15 miles per year up to 1920. This will be just sufficient to complete the extension schedule called for in Chapter 3, and is also required to catch up with the normal growth in population. From 1868 to the time of the Market Street Railway Co. consolidation in 1893, track mileage was extended at the rate of 8.1 miles per year; during the maximum period, 16 miles per year. Since the consolidation, the rate of growth has only averaged 3.6 miles per year.

12. The total operating equipment of all companies in 1911 was 676 cars. Prior to the fire, there were many more cars reported, but of smaller capacity, averaging about 30 seats, as against about 42 seats at the present time. Several hundred obsolete and worn out cars were retired in 1907.

13. The total seating capacity at the present time appears to be about the same as before the fire, but it is a question whether the *service capacity,* in proportion to traffic, is as great even in view of the increased schedule speed, owing to the exodus of population from the inner city to the outlying districts within the last census period.

14. Assuming the new equipment now on order by the United Railroads had been available to rectify the service requirements of 1911, the future growth of the city until 1920 will require an average addition of from 40 to 50 cars per year. This is a minimum schedule that can be carried out without materially diluting the net earning capacity, as San Francisco has already the highest earning rate from its equipment of any large city in the country. From 1889 to 1896, an average of 67 cars per year was added to the system with maximum rates of increase within the period of from 140 to 200 per year.

15. The only way the above increase in equipment called for may be reduced is through the more efficient use of available car miles by improved routing and by further increase in schedule speed. The size of the car units has about reached a maximum for the streets of this city.

16. That the extension schedule of track and cars called for here is not unreasonable is further indicated by the fact that out of the annual budget of investment predicted, about 25% will

remain up to 1920 for betterments of existing property over and above the investment in new extensions and equipment.

17. An analysis of the purchasing power of the City with respect to its utilities shows that the underlying property valuation is increasing at a slower rate than the necessary railway investment—viz.: as the 1.7 power of the increase in population, instead of the square as in the case of earnings. At the very lowest estimate, $3.00 of capital must be invested for every $1.00 earned. Under the present bond limit, therefore, the City's ability to purchase or build is becoming more and more inadequate, thus requiring a progressive refunding basis.

18. The present available purchasing power of the City is approximately $51,000,000 for all purposes, including water supply. By 1930 the total railway investment required will be $62,000,000; by 1950, $123,000,000. This means that over one-third of the total bonding capacity of the City on its present 15% basis would be continually pre-empted for railway investment alone, *assuming the City entirely free from debt.*

19. If the City of San Francisco declines to accept the assistance of private capital in financing its utilities both for the present and the future, the conclusion cannot be evaded that a revision of the bond limit must be secured immediately in order to provide the capital necessary for preserving the normal rate of growth of the city as herein predicted.

GENERAL DISCUSSION

Of the various factors involved in the growth of a large city, two stand out predominantly as absolute indices of the city's growth:

1. Growth and density of population.
2. Increase in property values.

The first is a measure of the source of income to all utilities. The second is a measure of the wealth and purchasing power of the city with respect to municipal undertakings. Supplementing these, a fair index of commercial growth is afforded by banking transactions in cities that are large enough to maintain an independent clearing house.

Growth in Population

Reviewing the history of San Francisco, the growth has been so rapid and erratic that unusual caution in predicting for the future is necessary. Referring to the graphical record, Fig. 1, it will be seen that the city grew with extraordinary rapidity from

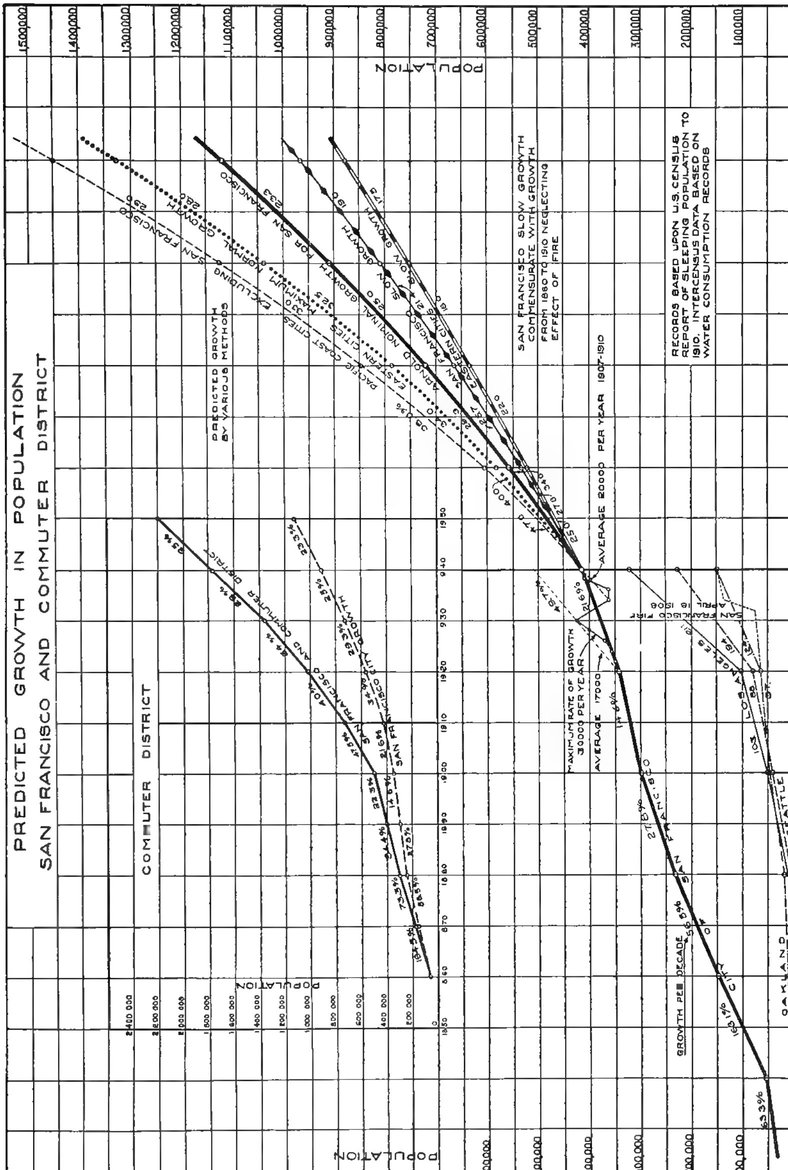

FIGURE 1—ARNOLD PREDICTION OF FUTURE POPULATION, SAN FRANCISCO AND COMMUTER DISTRICT.

Upon a prediction of population growth fundamentally rests the possible future of transportation, traffic, earnings, service and investment. The conservative nature of this estimate for San Francisco, shown by the heavy black line, is apparent from comparison with the other curves of possible future growth which are presented for this purpose. The Commuter District includes all communities commercially tributary to San Francisco. Note the rate of in- ... Francisco 34% or including the Com-

1860 to 1880. Then ensued a period of retarded rate of growth until 1902, when a new period of unprecedented activity began, extending up to the time of the fire, with an average rate of growth of about 30,000 per year. Had the average rate from 1900 to 1905 continued, San Francisco today would have had a population of approximately 550,000 people. At the present time, 1912, the population is approximately 450,000.

Effect of the Fire of 1906. As a result of the fire, the population in 1907 stood practically the same as in 1902. But it is an encouraging fact that since this time the city has grown *faster than the average before the fire,* viz.: 20,000 persons per year, so that the real rate of growth of San Francisco within the last decade has been at the rate of 54% as against 21.6% shown by the census figures. This higher rate is only exceeded by two decades in its past history. Just prior to the disaster, the population of this city has been estimated as 450,000 (on a basis of average school attendance). Following the fire, an immediate exodus of 275,000 people took place (based upon General Greeley's estimate). If this estimate is correct, about 100,000 people have never resettled in San Francisco.

This is confirmed by considering the expansion of transbay residence territory outside of the industrial district,* such as Marin County and the Peninsula. But it is also true that the metropolis is regaining lost ground at a rapid rate, and will continue to do so. In fact, transbay traffic statistics indicate that Oakland, Berkeley and Alameda are rapidly becoming commercially self-centered and self-supporting, and San Francisco and Oakland will continue to grow in the future as supplemental communities without any further marked transference of population such as occurred after the fire. This is as it should be, and it remains only for San Francisco to develop the attractive residence districts within its own borders to maintain its present rapid growth.

The influence of the great fire in accelerating the growth of the suburban Bay communities has been marked. Oakland, by census estimate, had gained but 5,700 people between 1900 and 1905, but increased 78,000 between 1905 and 1910. Similarly Berkeley gained 5,400 population during the first five years and 22,000 during the last. The entire bay industrial district, exclusive of San Francisco, increased only 15,000 between 1900 and 1905, and 114,000 thereafter, within the decade.

Future Growth. The analysis upon which the future growth is based has included the following considerations:

*Including San Francisco, Oakland, Alameda, Berkeley, and Township No. 1 of San Mateo County.

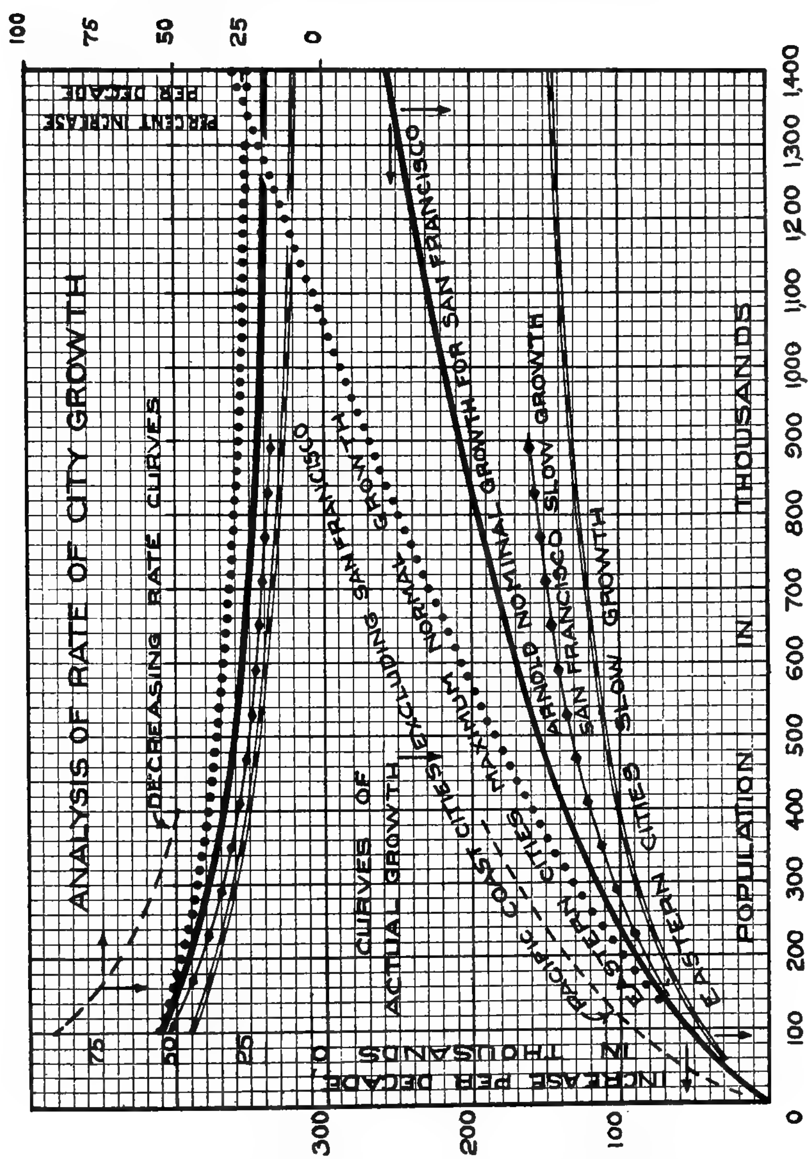

FIGURE 2—ANALYSIS OF LIMITING RATES OF POPULATION GROWTH.

A survey of this nature is necessary to reach reasonable conclusions for the future in a city subject to such erratic growth as San Francisco. These curves demonstrate the indisputable fact that cities grow with a decreasing rate of increase. For example, it was found that normal Eastern cities of 500,000 inhabitants grew at a rate of 185,000 in 10 years, or 36 per cent (see curves, dotted code), while at a population of 1,000,000 the rate had decreased to 27 per cent, although the actual increase was 290,000 per decade. Any fixed rate or percentage compounded through a long period would usually lead to impossible results. This study forms the basis of the prediction curves, Fig. 1.

1. San Francisco, the commercial metropolis of the West.
2. Effect of the opening of the Panama Canal.
3. Temporary effect of the Panama-Pacific Exposition.
4. Climatic and scenic advantages of San Francisco.
5. Effect of unusual isolation of San Francisco.
6. Growth of other Pacific Coast cities.
7. Normal and slow growth of Eastern cities.
8. Maximum and minimum past growth in San Francisco.

The basis of analysis is best indicated by the growth characteristic curve, Fig. 2, in which the *actual increase per decade* is recorded at various stages of growth in the development of cities. Thus, for a city of 450,000 inhabitants, such as San Francisco at the present time, an actual increase per decade is recorded as follows:

Eastern cities, slow growth	105,000 per decade
San Francisco, slow growth	125,000 per decade
Eastern cities, max. normal	170,000 per decade
Other Pacific Coast cities	210,000 per decade
Arnold estimate, San Francisco	145,000 per decade

These composite curves recognize an unquestioned fact in the growth of cities that normal growth takes place with a *decreasing rate of increase.* The conservative nature of the rate finally selected for San Francisco will be apparent from a study of this curve. It is neither optimistic nor pessimistic. And although the predictions may very likely fall short of the next census, it would be entirely improper to recognize erratic growth, although such may have been recorded in the past. From the "Arnold Normal Growth Curve" the following prediction for the future City of San Francisco is obtained:

San Francisco—

Decade Ending	Decade Increase per Cent	Population
(1912) estimated		(450,000)
1910	21.6	416,912
1920	34	558,000
1930	29.3	722,000
1940	25	909,000
1950	23.3	1,121,000

In establishing the initial percentage for the present decade, the probable fact has been given weight that a considerable part of the permanent loss due to the fire will be made up by the permanent gain due to the Exposition.

Commuter District. It is desirable to predict in the same manner the growth of the commuter district that may be properly termed tributary to San Francisco (as defined in Table 2). Practically the same basis of analysis has been used, and although an extraordinarily rapid growth of the Bay cities has occurred within the past decade, the rates used have been tempered with due conservatism:

San Francisco and Commuter District—

Decade Ending	Decade Increase per cent	Population
(1912) estimated		(788,000)
1910	47.5	730,000
1920	40	1,019,000
1930	34	1,366,000
1940	29	1,760,000
1950	25	2,202,000

A clear idea of the extent of this commuter district may be best obtained from the General Transportation Map, Plate 2, showing both electric and steam lines entering the city, and those converging from the surrounding districts to the bay ferries. Moreover, the relative growth within the last two decades is indicated in order to give a graphical picture of the correct position of San Francisco in respect to its neighboring communities. For example, the Alameda County cities have more than doubled their population in the last decade, while San Francisco improved upon its previous 10-year growth. Or considering all of the commuter towns only, it is found that the population has more than doubled, while with San Francisco included, the total rate of increase has been nearly 48%, the highest of the last three decades. This commuter district including San Francisco differs from the "Industrial District" of the census by including many residential suburbs not devoted to manufacturing.

Distribution and Density of Population. It will be well for those interested in the growth of the city to study carefully distribution map, Frontispiece, which represents accurately the distribution of population of the 1910 census by the actual enumerating districts. Two so-called "congested districts" of the city are clearly evident as "Chinatown" and "Japtown." The former has the greater density, although by the splitting of assembly districts in 1910, the actual figures of density do not appear as high as in Japtown at the present time. (See Table 3.) Outside of these two districts, those parts of the city that may be now reached by transit lines are found to be settled quite uniformly.

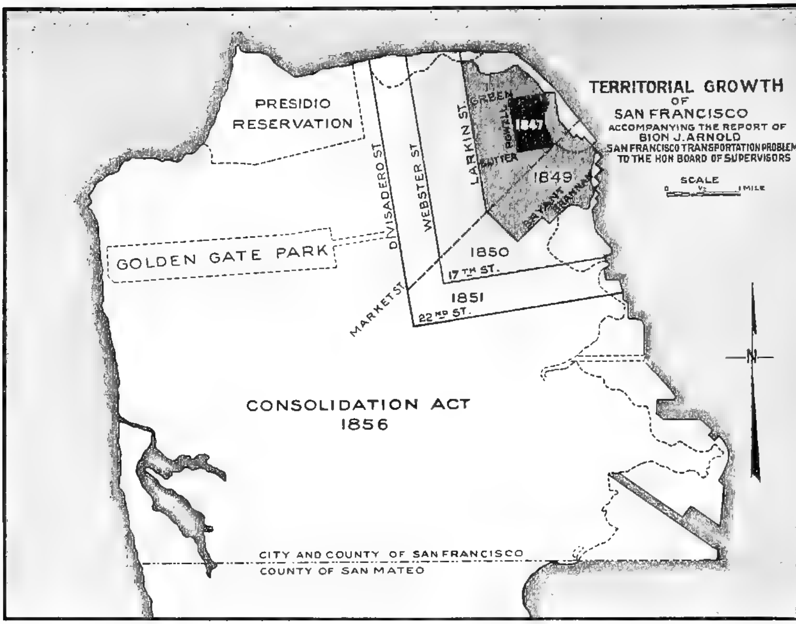

FIGURE 3—TERRITORIAL GROWTH OF SAN FRANCISCO.

Municipal boundaries have very little relation to the broad movements of population as compared with transit service. In studying growth of transportation it is therefore necessary to know whether the census records actually cover the settled districts tributary to the various transit lines of the city. In San Francisco the city boundaries have generally preceded settlement. Starting with the village Yerba Buena, indicated in black, now entirely within the business district, the city boundaries quickly expanded within four years of its incorporation to the intersection of Divisadero and Twenty-second streets; and only five years later, upon the consolidation of the City and County of San Francisco, to the San Mateo County line. San Francisco's tributary population will probably not expand to any great extent down the Peninsula until more convenient rapid transit facilities are provided.

The 30-minute time zone practically marks the limits of heavily settled districts and will continue to do so even after more rapid means of transportation are provided.

From this map, Frontispiece, it needs no argument to reach the reasonable conclusion that with adequate transportation and other utilities, Richmond, Sunset, Merced and Visitacion need not long remain practically unpopulated as at the present time.

If the city be divided into three zones, thus:

(1) Within the one-mile circle;
(2) Between one and three-mile circles;
(3) Outside the three-mile circle,

it is found that today only 75,000 people live within the one-mile circle, 98,000 outside of the three-mile circle, with 244,000 in the intermediate zone; and that while the densities of the inner and intermediate zones are nearly the same, that of the outer zone is only six persons per acre, approximately one-sixth of that within the three-mile circle, which to a certain degree corresponds to the 30-minute time zone previously mentioned.

Taking the U. S. census for the last three decades, a further comparison may be made on the basis of assembly districts (Plate 5), although the continually changing boundaries of these districts make a direct comparison of local centers difficult as between census periods. However, the census records are illuminating as applied to the so-called "inner city," shown within the heavy boundary lines of Plate 5 and covering approximately the district bounded by Van Ness Avenue on the west and Bryant Street on the South.

Year	Population, Inner City.	Area, in Acres, Inner City.	Density. Persons per Acre.* Inner City.	Outlying.
1890	157,400	1765	89	6.6
1900	152,000	1789	85	6.9
1910	86,200	1725	50	15.0

From these data, it is clear that as a result of the fire, the inner city has very greatly changed in its character of settlement and has lost about 71,000 population, while the outlying district has increased 189,000. This means that owing to extensions of transit lines, the inner city has been transformed into a business district, and the former population has scattered to the residential and suburban areas. This is as it should be, and although the extensive building of apartments and hotels within the inner city will draw the great majority of transients, it is not believed that this movement will materially affect the migration of the homeseeker to the many attractive suburbs available, *provided* transit extensions keep pace with this expansion.

Finally, considering the smallest civil division, it appears that the maximum density of any district of San Francisco occurred in 1890—224 persons per acre in the district including Chinatown, with six other districts of the inner city above 100 per acre. In 1900, the maximum density was 141 per acre, with only three districts above 100 per acre. In 1910 the maximum density had fallen to 70 persons per acre in Japtown, entirely outside of the

* These figures of density deduct all the unpopulated areas such as parks, reservations and waterlot areas.

so-called "inner city.*" This unquestionably indicates the exodus of residence population out of the business district, which is desirable and necessary to the healthy growth of a municipality. This cannot fail to greatly enhance the necessity for and earnings of street railway properties in the future by an increased riding habit.

Commercial Growth

Incidental to this study, the graphic record of commercial growth, Fig. 4, has an important bearing, as follows:

Population by census years, bank clearings, assessed valuation of property, real estate assessed, real estate sales, building operations, telephone calls, post office receipts.

Property valuation reflects the fundamental underlying wealth of the community, bank clearings measure its major financial operations, and post office receipts offer a fair indication of the general prosperity of the average citizen.

A general review of these records shows a period of great activity in San Francisco from 1900 up to the depression of 1906. But by 1910, the city had practically recovered, and is now progressing at an encouraging rate.

Bank Clearings have maintained a normal increase since 1896, and are now 47% above 1905. It is a significant fact that although bank clearings suffered a temporary check during a few months after the fire, the total clearings for the year 1906 actually increased at a normal rate and were only checked by the wide-spread financial depression of 1907-8, since when the previous rapid increase has taken place.

Property Valuation remained fairly constant up to about 1888 (with the exception of a temporary increase in 1880) and has since increased at a normal rate up to 1905. Since the fire the valuation has increased at about the same rate as before the fire. Fig. 4 indicates the relative amount of operative property exempt from city taxation.

Real Estate Value, as assessed exclusive of improvements, shows that the fundamental basis of land is barely as high as before the fire, and that the assessment is hardly keeping pace with the total property assessment upon which the purchasing power of the City is based.

Real Estate Sales show a sudden increase from 1900 to 1905 with the exception of two intervening years. Since the fire, progress has been slow, but the last year indicates a renewed growth.

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* Even these maximum densities in San Francisco are small compared with other cities, such as the lower East Side, New York, which exceeds 1,200 per acre.

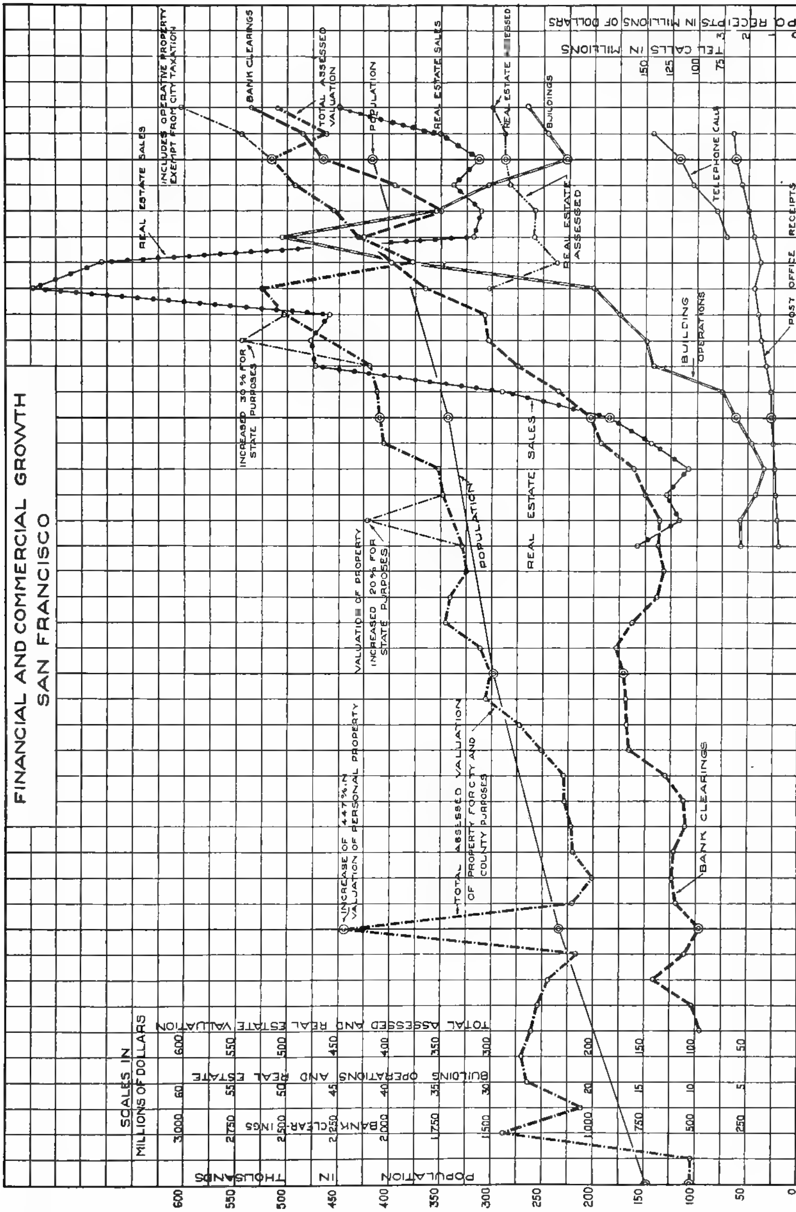

FIGURE 4—EVIDENCES OF COMMERCIAL GROWTH OF SAN FRANCISCO.

To plan consistently for the future, a knowledge of the past is essential in order that erratic growth may not lead to false conclusions. This study presents the most important indices of the underlying commercial strength of the community, which alone determines the future of the city, both in population and resulting transit development. In spite of the depressions of 1906 and 1908, San Francisco is again moving forward at a satisfactory rate, especially during the last year, and its commercial operations now generally exceed those of the previous high point—1905.

Building Operations followed a normal growth from 1898 to 1905. Naturally the tremendous building activity resulting from the fire could not be maintained. Since 1910, however, building operations have again gone forward at a normal rate.

Telephone Calls are increasing at a consistent rate, having practically doubled since the fire.

Postoffice Receipts show the most uniform and healthy growth, with only comparatively small depression as a result of the fire, and have more than doubled in the last decade.

Manufactures. Finally, an examination of the Census reports of the operation of the industrial district of San Francisco before and after the fire indicates some startling facts, detailed in Table 4. Comparing the three years 1900, 1905, and 1910, it is found that both the number of factories and persons employed were less in 1910 than the year before the fire, although the value of products had slightly increased. On the other hand, a very rapid increase in manufactures had taken place during the five years preceding the fire. Furthermore, it appears that what San Francisco has lost as a result of the fire has been a direct gain to the Bay cities of the industrial district. If these records are analyzed on a *per capita basis,* it appears that while the percentage of population employed in San Francisco in manufactures has decreased by nearly one-fifth, that of the Bay cities has increased by about the same amount, but also that the per cent employed for the entire industrial district was lower in 1910 than in 1905 or 1900. The total value of products per capita has also decreased. This record clearly indicates the serious fact that up to 1910 manufacturing has not kept pace with the growth in population, and that the industrial district must become more united in developing the manufacturing facilities which the Bay shores afford. This furnishes an additional argument for the establishment of a Metropolitan District Control in such matters of common interest as utilities and industries.

Prediction of Traffic and Service

The final object of this analysis of growth is a prediction of future transit earnings, the necessary equipment and the corresponding investment required to produce those earnings, thus making it possible to determine beforehand the ability of the City to assume the burden of this investment.

An analysis of the relative growth in earnings of street railways, and population, in many cities of this country, has developed a clearly defined mathematical law. And although there are

some cities varying considerably from this general law, the great majority closely adhere to it, as stated below:

> That the total annual railway earnings increase approximately as the *square* of the increase in population; that is, by the time the population doubles, transit earnings will have increased four-fold. Or in other words, the earnings *per capita* will increase approximately in *direct* proportion to the increase in population.

This relation may best be shown graphically as in Fig. 5, wherein are shown the results of four decades of development in San Francisco, together with a prediction for four decades into the future. Barring the erratic development in the last decade, especially 1905-1908, the averages for the period are instructive. While the rate of growth in earnings from 1900-1903 considerably exceeded the average, due to delayed increase in population, and on the other hand the reverse condition appears from 1908 to 1911, it is safe to say that San Francisco at least approximates if not exceeds the law above stated, and will continue to preserve that relation for at least the remainder of the present decade—*i. e.*, to 1920.

By way of illustration, the following figures would result if the law of the squares were applied to the present San Francisco for several consecutive decades before and after the present time:

LAW OF THE SQUARES.

Population.	Per Capita.	**Earnings.**
200,000	$ 8.75	$ 1,750,000
400,000	17.50	7,000,000
800,000	35.00	28,000,000

However, it must be recognized that in San Francisco, owing to its limited ability to grow within its present boundaries, there will come a time when a "saturation point" will be reached in the possibilities of adequate service from surface line extensions within the city limits and a decline in growth of total traffic and earnings must then set in, unless rapid transit facilities are undertaken so as to properly serve the outlying districts undergoing development Therefore, in this prediction, Fig. 5, the index of growth has been progressively decreased by decades from 2.0 at the present time to 1.5 in 1950. This is done with the full knowledge that rapid transit facilities must come sooner or later, which alone will revive the total earning power of the system, as has been the case of other cities. This estimate may then be regarded more as an index of surface railway operations, although possibly including some rapid transit development.

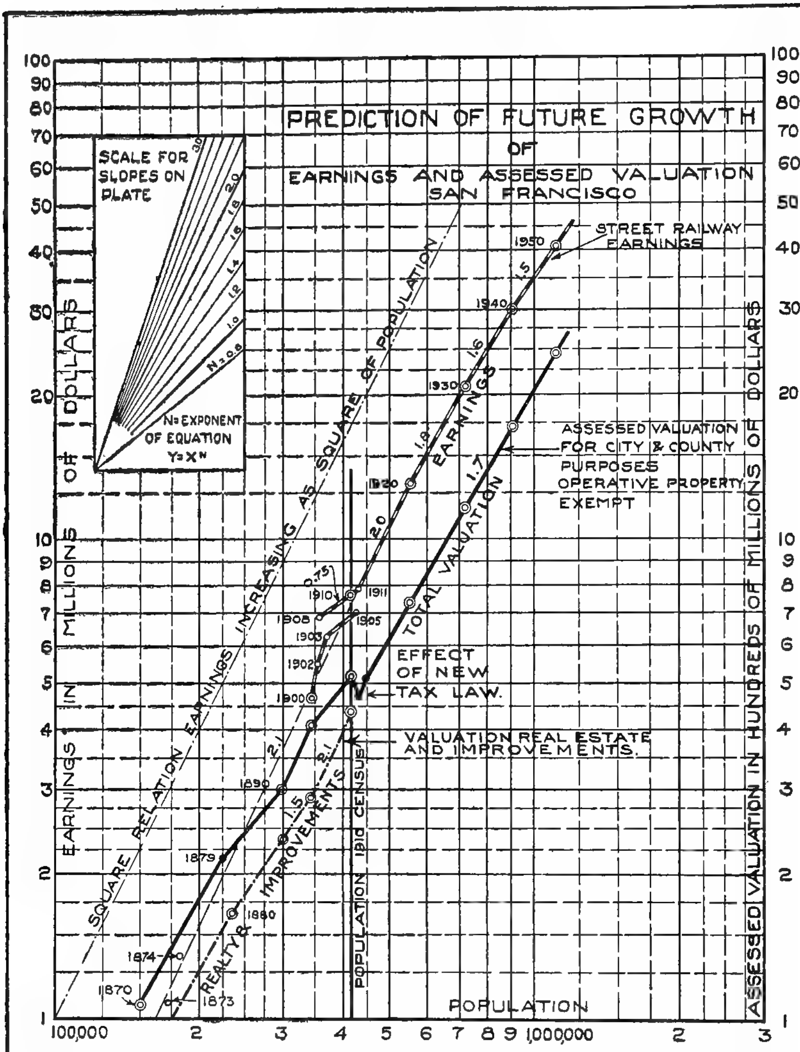

FIGURE 5—ANALYSIS OF MATHEMATICAL LAW OF GROWTH.

Upon this law rests the future of the city in respect to transit earnings and investment in the necessary railway properties. It answers the question, How fast will earnings and investment grow with reference to the population? San Francisco has exceeded many other cities in the past with earnings growing faster than the square of the population; and valuation of property somewhat below this rate. This means that when the population doubles, property valuation more than triples, and earnings quadruple. The broken guide line indicates this square relation. A line parallel thereto conforms to this law. For the distant future the rate of earnings has been conservatively decreased, as this study refers largely to surface transportation, not including expensive rapid transit projects.

On this modified basis the predicted earnings then stand as follows, with the approximate traffic resulting therefrom, which may be taken for this purpose on a basis of a flat 5-cent fare (Table 5):

PREDICTION—MODIFIED LAW OF THE SQUARES.

Population.	Earnings per Capita.	Earnings per Year.	Revenue Passengers per Year.	Total Passengers per Year.*	Approximate Year.
200,000	$ 8.75	$ 1,750,000	35,000,000	52,500,000	1876
400,000	17.50	7,000,000	140,000,000	210,000,000	1909
800,000	31.25	25,000,000	500,000,000	750,000,000	1934

Increase in Equipment

It has been impossible to obtain complete official records of equipment prior to the fire, as accurate utility records were not then compulsory. While the records here presented do not entirely agree with recent official data, they will suffice to illustrate in a general way the development in this city.

Track Mileage. The record of total track construction, Fig. 6, indicates a uniform growth from 1868 to 1889 of about six miles per year, then an extremely rapid increase from 1889 to 1896 of 16 miles per year, during which period the Market Street consolidation took place. No further increase is recorded up to 1902, when rapid building again ensued until stopped by the great fire of 1906. Since the fire, extensions have about offset abandonments, so that the total track has remained practically constant. Summarizing, an average of 8.1 miles per year was maintained from 1868 up to the time of the Market Street consolidation in 1893, and since then only about 3.6 miles per year. Thus, the last 15 years of growth has been slower than any previous considerable period of time in the history of the city, even during the original horse-car days. Whatever the cause, this can only be interpreted as a retrenchment of that natural growth essential to the welfare of the city which finds its logical result in the present necessity for a very large increase in mileage to compensate for the delayed expansion.

*Assuming 50% transfers.

Footnote: *Explanation of Graphical Analysis.* This study, Fig. 5, differs from the ordinary method in that the relation between the two variables—earnings and population—is plotted on logarithmic cross-section paper instead of the usual rectilinear section paper. There is this difference: Assuming that earnings increase as the square of the increase in population, this relation on linear section paper would show a rapidly ascending curve of earnings; but on logarithmic section paper *the curve becomes a straight line,* with a slope of two to one. And any other relation between two variables that plots out with a slope of two to one may be recognized at once as conforming to this law of the squares. Similarly, a relation with a slope of three to one conforms to the cube. Hence, on logarithmic paper it is only necessary to focus attention on the slope of the line to determine accurately the mathematical law; and any line parallel to the guide line shown on Fig. 5—*i. e.,* having the same slope—follows the law that doubling the population quadruples the earnings. Although it is to some extent unsafe to apply a law rigidly so far into the future that a complete revolution in transit methods might occur, it is at least safe to follow this law for a decade hence. The fact that the law of the squares has been approximated in the past with four different methods of motive power indicates the reasonableness of this conclusion.

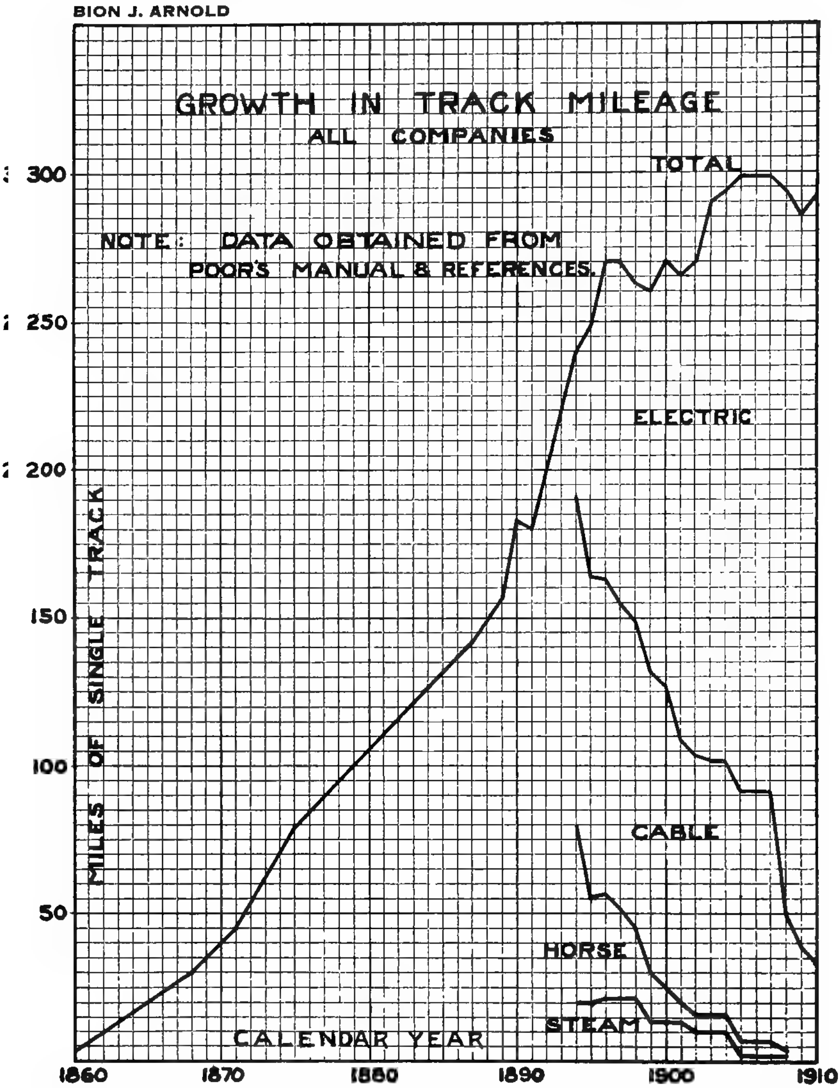

FIGURE 6—GROWTH OF TRACK MILEAGE IN SAN FRANCISCO.

This record shows three decades of normal and continuous growth, followed by a period of extremely rapid growth coincident with the introduction of electric traction. But since the consolidation of the Market Street system the growth has been erratic and on the average comparatively slow. The almost complete revolution in the method of railway propulsion for the last two decades is clearly shown. Data prior to the fire may be subject to slight error, but are sufficiently accurate for indicating general tendencies. From 1889 to 1896 the system grew at an average rate of over 16 miles of track per year. Since the Market Street consolidation in 1893 the growth has averaged only 3.2 miles per year. (See Table 8.)

Analyzing this growth with reference to population, it appears that the track mileage increased faster than the population from 1860 up to 1896, since when it has fallen behind. It is not an unreasonable conclusion that if transportation companies found it possible, up to the time of consolidation of the properties, to extend their lines at a much *faster rate* than the population, that a rate at least *proportional to the increase in population* can now be maintained until such time as surface extensions have reached their limit. According to this basis of normal increase, a total of 100 miles would be required for the next decade.

But this assumes that the present trackage is adequate, which it not the case. As a matter of fact, the extension schedule is from 6 to 9 years behind. And moreover, to carry out the program of extensions that are definitely needed as detailed in Chapter 3, 120 miles of new track will be required, probably by 1920, the construction of which would call for an average rate of about 15 miles per year, which is less than has previously occurred in San Francisco. Of this, the major part falls to the United Railroads.

Car Equipment. The graphical record of car equipment, Fig. 7, shows a gradual replacement of horse and cable cars by electric equipment since 1895. It also indicates that the total number of single cars used in San Francisco today is practically the same as in 1889, prior to the establishment of electric service, and only about half the total number reported in 1896. This record, however, is probably based on total *cars owned*, as reported by the companies in the available statistical records. Furthermore, the present cars are much larger, and a uniform definition of car unit was not in all cases used. The records prior to the fire must therefore be interpreted with caution, and probably include much equipment either obsolete or retained for emergency service only. The present equipment as now reported does not any longer include the large number of obsolete cable and horse cars that are still in evidence at some of the old car houses in various parts of the city.

From the curve it is apparent that several hundred of these cars were retired at the time of the fire, and from actual observations the entire system is now being reported practically upon a basis of operative cars.

An effort was made to determine this gain or loss in equipment from the official records of operating car units upon which license taxes were paid to the City. Prior to 1898 the records appear entirely undependable. The disparity between total equipment reported and operating cars is great. Thus, out of a total of 1146

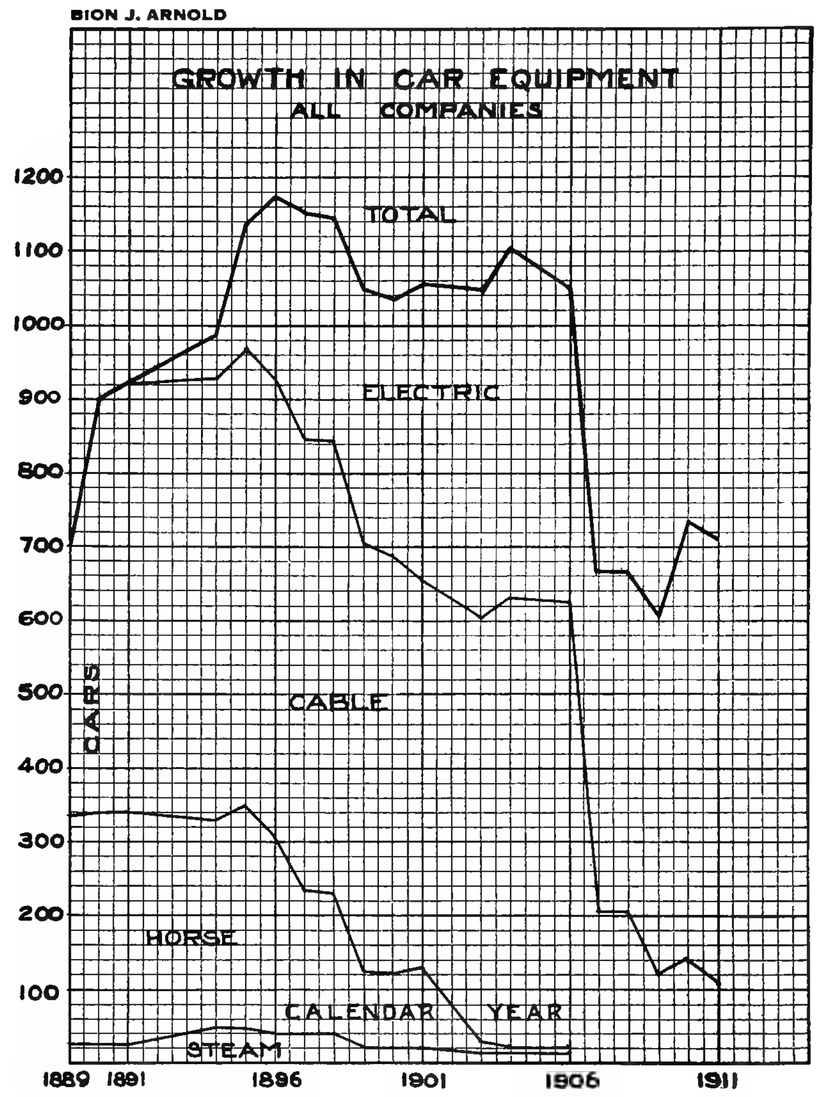

FIGURE 7—GROWTH AND CHANGE IN CAR EQUIPMENT.

This record probably does not represent cars actually operated, prior to the fire, as it is based upon equipment reported as *owned*. The enormous decrease in equipment is due to the retirement of several hundred cable cars, either worn out or obsolete, by reason of the change in motive power. Since the fire the record covers, in general, only cars available for service. The average seating capacity per car probably increased during this change from 30 seats to 42 seats, or 40 per cent. (See Table 7.)

cars in 1898, taxes were paid on only 600 equipments. After the fire, however, taxes have been paid on a greater proportion of the total equipment—at the present time, on 88% of the total.

The principal point of interest in this exhibit is a net change in seating capacity from 1905 to the present time. The official public statements (for taxable purposes) of all car equipment, Table 7, showed 921 United Railroads cars in 1905 and 669 in 1912. Counts in 1912 indicated 661 for the United Railroads system. These old cars probably contained 28 to 34 seats each; an average of 30 seats may be assumed. Traffic counts during 1912 showed 607 United Railroads cars in operation; these average about 42 seats each. In other words, with about the same estimated population, the seating capacity is now practically the same as before the fire.

But in this period 66,000 residents, nearly one-half of the population of the "inner city" or walking district, moved to other parts of the city, thus becoming dependent upon car service. This additional traffic represents 15% of the population of the entire city. On the other hand, the United Railroads system has increased in schedule speed within the same period 12%, with a corresponding increase in service capacity for the same equipment. Whether the service has fully recovered since the fire is therefore a question. In any event, it is clear that the present equipment is far short of the requirements of service brought about by the general growth of the city, as determined by actual counts (Chapter 7).

It now remains to estimate, *for the entire traction system*, the proper rate of increase in car equipment and car mileage for the future. This may be approximated by several methods, as follows:

*1. Assuming a uniform density in cars per mile of track, and increasing in proportion to track mileage.
2. Assuming a fixed income per car year, and thus increasing in proportion to the gross earnings.
3. Assuming a fixed operating ratio, expenses per car mile, and car mileage per car year, and increasing in proportion to the gross earnings. (See Table 6.)

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*First—The car density resulting from a total of 741 cars averages for 1911 2.52 cars per mile of track. For a total trackage in 1920 of 414 miles there will be required 1,043 operating cars; or adding 5% for reserve and repair, a total of 1,095 cars, equivalent to 39 cars added per year. This represents a minimum, as the car density in San Francisco is low.

Second—The average income in 1911 for 741 cars was $11,600, which is much higher than in other cities. For gross earnings in 1920 of $13,100,000, a total of 1,176 cars would be required, or 48 per year.

Third—Taking the present operating ratio, including taxes, of 65%, an operating expense of 20 cents per car mile, and the present yearly mileage per car of 36,700 miles, the estimated earnings for 1920 of $13,100,000 will require a total of 1,218 cars, or 53 per year.

The total *operated* equipment for all companies for 1912 was 676† cars; or adding thereto the 65 new cars now on order, 741 cars, upon which predictions may be based.

Thus it appears that on the present operating basis, 39 to 53 cars per year should be added to the entire system. (See Page 157.) That this latter rate is entirely practicable is shown by the fact that it would permit earnings of about 10 per cent on the investment, assuming $3.50 invested for each $1.00 of earnings.

The only way in which this car purchase schedule can be reduced for the same service is that proportionate economies in operating car mileage be introduced by means of increased speed and effective re-routing of present lines. (See Chapter 7.)

Purchasing Power of the City

The tax assessment roll may be taken as a measure of the purchasing power of the City in the construction or acquisition of great public works. At the present time, the bond limit is fixed at 15% of the assessment, with only about $51,000,000 available for all utility purposes, by reason of the failure of the electors to permit the City to bond itself outside of the present debt limit for *revenue-producing utilities,* such as water and street railways. There will thus be available for future acquisition of such properties an annual amount proportionate only to the increase in total property valuation.

Analyzing the past growth graphically (Fig. 5), it is found that in San Francisco the value of real estate and improvements has increased since 1873 at a rate proportional to the 1.7 power of the increase in population—that is, nearly as the 2.0 power or square as above referred to in discussing growth of earnings. This rate exceeds that of most of the older cities of the East. However, it appears that the personal property valuation has increased less rapidly than the realty, with the result that an average index of growth of only 1.5 power has been maintained in the past, upon which the bond limit is computed. For the future, it is believed that the realty values will control, and consequently the total assessment roll has been predicted upon the index basis of 1.7 power. From these totals must be deducted operative property that is now exempt from City taxation through recent changes in the State tax laws.

Investment Necessary. The final deductions from the foregoing analysis are fraught with the greatest importance, not only

†From record of car licenses paid. Table 7. This is 13 greater than the actual number found on the streets but is used inasmuch as it is a public record.

to San Francisco, but to every municipality contemplating exclusive municipal ownership. In the proper expansion of a utility system, a definite ratio between investment and earnings must exist; for example, in street railways from three to four dollars of capital must be invested under modern conditions of operation and with a flat five-cent fare, to produce a standard property and equipment. The future earning capacity has already been determined. By applying this ratio, the total investment necessary results, with which may then be compared the purchasing power of the City under the present basis of assessment and taxation. The actual figures are given below:

FINANCIAL SUMMARY OF FUTURE GROWTH

Year	1912	1920	1930	1940	1950
Population (thousands)	443	558	722	909	1,121
Street railway earnings (millions)	8.4	13	21	30	41
Total assessed valuation for city and county (millions)	511	750	1,160	1,710	2,420
Investment in street railway property of \$3 to \$1 earned (minimum) (millions)	25	39	62	90	123
Bond limit (15% of valuation) (millions)	77	113	174	257	363
Per cent of present bond limit necessary for railway investment	33	34.8	35.9	35.1	33.9

This table shows that an average investment of at least \$1,750,000 per year will be required to 1920. Comparing therewith the required investment rate called for in this report, it is found that 15 miles of track and 50 new cars per year will leave a substantial proportion of the annual budget available for betterments of existing property—probably 25%, or \$450,000 per year. This shows the reasonable nature of the extension schedule called for.

The assumption of an investment ratio as low as \$3.00 per \$1.00 earned must be clearly stated as applying only to a system which is properly expanded year by year in proportion to the growth in population, and the above table shows probably the minimum investment necessary to develop such a system. If rapid transit undertakings in any form should be carried out during the intervening period, a considerably higher investment ratio would result, somewhat according to the following plan:

Rapid transit subways	\$6.00 to \$8.00
Electrified steam lines	4.00 to 6.00
Street railways	3.00 to 4.00

Nor is it correct to even assume that the United Railroads investment will continue along this curve so long as a practical monopoly in San Francisco is maintained; for unless an agreement can be reached between the City and the Company providing for normal development and extensions, it is entirely possible that the United Railroads will be content with earning out of the present system all that is possible up to the termination of its franchises. As the City has no power to compel extensions, the traffic density will continually increase and the proportionate net earnings likewise.

From the above it must be evident that unless some revision is made in the basis of the bond limit for the purposes of investment in municipal utilities, the City can never hope to either acquire nor much less construct a complete transit property of the character necessary to meet its great future. The above table shows that over one-third of the total bonding capacity on the present basis would be continually pre-empted for railway investment alone, assuming the City entirely free from debt.

It is necessary to state plainly that these conclusions cannot be evaded. The investment must be made if the transit facilities of San Francisco are to advance in proportion to its needs, and it was for this reason that the provisions of Charter Amendment No. 34 were so drawn as to permit private capital to assist municipal development until such time as the City could take over its utilities upon an adequate bonding basis as in the case of New York City in its latest subway acquisitions.

CHAPTER 3

DEVELOPMENT OF TRANSIT SYSTEM*

Unified and Municipal Lines
Facilities for Serving Panama-Pacific Exposition
Rapid Transit Development

San Francisco, unlike many other cities, is not over-expanded, which, coupled with the rapid growth confronting the city due to the opening of the Panama Canal and the Exposition, as well as the very inadequate transportation facilities now available, makes street railway extensions of most immediate and far-reaching consequence. Further, the comparative isolation of Harbor View and the service requirements of the Exposition render the determination of a satisfactory plan for this service imperative. In this chapter, extensions essential to a complete operating transit system are recommended to satisfy both present and future needs. This consideration of future extensions is necessary to provide a definite plan of improvement and to avoid haphazard development. For the purpose of considering independently the extension of the municipal system, the general program is subdivided into both private and municipal competitive lines. Special attention has been given to developing adequate transportation and terminal facilities for the Exposition, both with and without tunnels, designed to form part of a complete and efficient transit system after the close of the Exposition. Such consideration is given to rapid transit projects as appears warranted by the present state of traffic development.

I. EXTENSIONS, IMMEDIATE AND FUTURE

Basis of Plan. The extensions herein recommended are designed mostly for a unified operating system, *irrespective of ownership—i. e.,* with a system developed only with reference to the best needs of the respective districts, and with duplication of capital investment eliminated. But this unified plan does not in any manner prevent the future control by the City of all of its traction lines, and may be regarded at the present time as simply the best means to a much-desired end—adequate service. From the standpoint of the patron, the ideal condition of service necessitates *one city, one fare, universal transfers.*

However, plans are also presented for the subdivision of this unified program of development into its component parts, one of

*Formerly Preliminary Report No. 10, submitted Dec. 2, 1912. and Dec. 7, 1912.

FIGURE 8 PRINCIPAL SUGGESTIONS FOR RAILWAY EXTENSIONS.

Incorporating all the principal ideas of improvement clubs, commercial organizations and individuals for extensions within the city; also such additional or modified extensions as are recommended in this report. Some of the evident duplication of parallel lines results from a desire for a competitive Municipal system. No attempt to distinguish between urgent and future extensions is made here. Various tunnel projects are indicated in white.

which contemplates a *privately operated* system, and the other a *municipally operated* system, both covering the entire city as far as possible, and operating in direct competition. But such a plan necessarily results in extensive duplication of investment along parallel streets and consequently duplication of service.* (Fig. 10.)

In planning this program of extensions, a thorough study has been made of the topography, available thoroughfares, and physical obstructions throughout the entire city, with a view to securing the most practical results; and the necessary street improvements involved are treated later, Chapter 12. It suffices here to note that the city may derive great advantage from a comparatively small amount of improvement work. The major improvements in the City Plan have been so thoroughly covered in the Burnham report that only such minor and relatively inexpensive projects are here contemplated as are essential to the proper development of the city and its transit system in the near future.

Similarly, definite consideration is later given, in the location of these extensions, to improved car routing and distribution of service. Particularly may be mentioned the necessities of so-called cross-town lines, making possible inter-communication between various local centers, of which there are many in San Francisco. (See Chapter 7.)

In fixing upon needed extensions all of the suggestions of improvement clubs and commercial organizations have been analyzed, and while many of them have been found impracticable owing to existing physical obstructions, mostly excessive grades, some of them are entirely warranted, and are included herein. Fig. 8 shows most of the more feasible extensions suggested. Of particular value may be mentioned the Merchants' Association report, submitted in 1907.

It is of interest to note, in this connection, that of all the extensions shown therein (some, I understand, were practically agreed to by the United Railroads), there have only been constructed short lines on Gough Street, Ninth Avenue, Fulton Street, Cortland Avenue, and through Visitacion Valley, and that most of the extensions of recent years have been financed through the assistance, either directly or indirectly, of the property owners benefited thereby; also, that *there have been no railway extensions whatever built under franchises granted since the last charter amendments took effect.*

*All of these extensions are indicated on relief maps, Fig. 10 and *Frontispiece* and are listed in detail in Tables 10 and 12 (Appendix) classified as to unified, municipal and private systems according to the construction time schedule recommended. Similarly Tables 16 and 17 (Appendix) list the operating routes necessary for proper service to the Exposition, both with and without tunnels. The approximate costs involved are summarized in Table 9 (Appendix).

Transportation facilities to the Panama-Pacific Exposition are dealt with in the succeeding section, and therein are recommended for immediate construction such transit lines as will best co-ordinate with this greater system.

CONCLUSIONS AND RECOMMENDATIONS

1. A study of the relative growth of population, operated trackage and riding habit indicates that the principal traction system in its extension program is at least six years behind the average rate established by the Company from 1900 to 1905, which was 6⅔ miles of single track per year. During the preceding decade an even higher rate was maintained—8¾ miles per year. Furthermore, extensions are by no means keeping pace with the growth in population, and only about 8 miles more track is now being operated than in 1905.

2. The apparent needs of the immediate future, determined independently of the above facts, require the construction of about 72 miles of single track, 94% of which is under municipal jurisdiction; and by far the greater proportion of this mileage is to be regarded as simply completing a delayed program.

3. Upon the completion of the above construction, five years hence at the most, a second construction program should be entered upon involving about 50 miles of single track, which may possibly be warranted within the present decade.

4. After this period further extension work should be steadily carried out as indicated, both in the outlying districts and within the city proper, solidifying and perfecting the present system. Inasmuch as San Francsco is hardly half developed, there remains much to be accomplished before a so-called saturation point shall have been reached, to justify retrenchment in extensions. This schedule of extensions does not include the necessary rehabilitation of the California Street line from Sixth Avenue to Cliff Avenue, which is now operating without a franchise.

5. This work will call for an approximate expenditure of about $6,000,000 in track and equipment within the next five years, and $11,000,000 for all the extension work indicated herein, exclusive of all special street improvement work, such as regrades, tunnels, etc., and exclusive of all rapid transit undertakings, except the Twin Peaks tunnel project already recommended.

6. At a very conservative estimate the investment in physical property should increase at the rate of $3.00 per $1.00 earned per year, and possibly at a higher rate. As the earnings for the

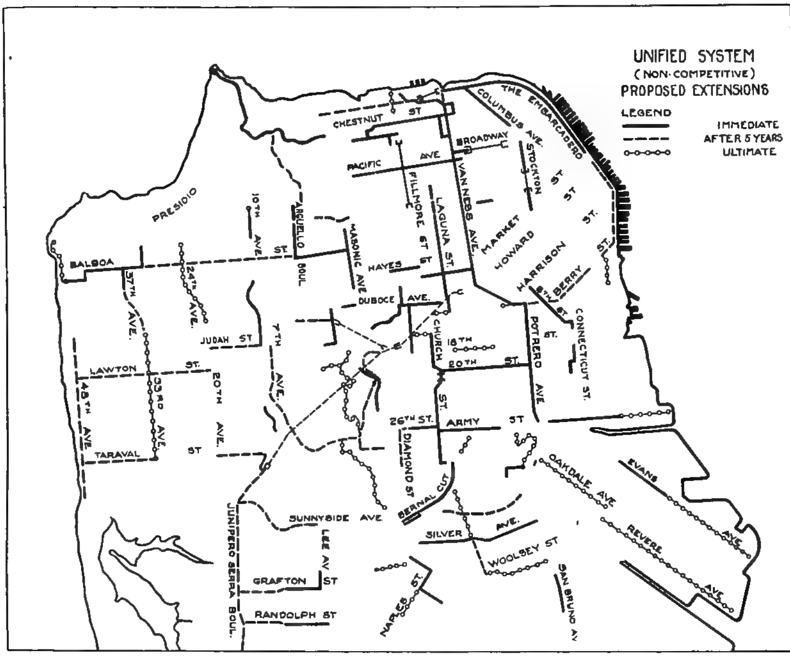

FIGURE 9—RECOMMENDED EXTENSIONS FOR UNIFIED SYSTEM.

Supplementing the detailed relief map (Frontispiece) on which all present lines are indicated, together with the distribution of population. This diagram shows in skeleton form the general location of extensions essential to a complete transit system unified with respect to operation—that is, providing patrons with the most direct transit and most convenient transfer facilities, irrespective of ownership. The program of extensions indicated represents the minimum mileage and investment. With competing systems extending throughout the entire city, the mileage of extensions necessary to accomplish the same degree of service would be considerably greater than here indicated. The legend subdivides this extension program into (1) Immediate; (2) Five years; (3) Ultimate. Should contour streets be later developed, modifications of this program would naturally result. Such tunnels as have already been recommended are here included as a fundamental part of the improved transit plan.

future are conservatively estimated as *doubling* in from fourteen to eighteen years, this means that within the next decade probably $18,000,000 will have to be invested in extensions, additions and betterments to the transportation facilities of San Francisco.

7. A large proportion of these extensions must be operated as part of the private system having no possible connection with the municipal lines, present or contemplated. But if these various outlying fragments were built by the city, some form of contract should be entered into to guarantee through service during the life of the trunk line franchise.

8. As the maximum benefit from service will be derived from extensions nearest the business center or into comparatively thickly settled suburbs, these should receive first consideration, prior to lines into thinly settled districts.

9. Certain development lines, however, are so clearly desirable and have such a certain future, that these might well take precedence over those development lines which are more or less speculative in final results.

10 For track in the outlying districts, a lighter and less expensive type of construction may be used which will serve amply for some years to come until the upbuilding of those districts requires rehabilitation with heavier track construction.

11. Single track construction, with turn-outs, will be justifiable in the case of some extensions into very thinly settled districts. This, together with the lighter construction employed, will so reduce the relative investment as to make it possible to serve a *much greater territory* than if standard construction were used throughout. But such single-track lines, if of reasonably permanent construction, especially as regards the substructure, should be laid *at the side of the street,* so as to be in position when the line is double-tracked and rerailed.

12. Extension lines should in general be so located as to best serve as feeders to future rapid transit trunk lines, and have been so considered here. This particularly applies to districts now requiring the longer rides in transit from the business center.

13. In outlying territory, where the streets and topography permit, a spacing between adjacent lines should be adopted which will divide the undeveloped territory with reasonable equality of service, as herein indicated. In other words, parallel lines should not be located nearer than three or four blocks apart, unless through exceptionally dense settlements. Otherwise considerable duplication will occur, as in the case of the upper Richmond district.

14. Several districts in San Francisco can never be adequately served except by the contour plan of street subdivision, as for example, University Mound and Larsen Heights, or the Sunset, Twin Peaks, and San Miguel slopes. If a method could be devised, a re-subdivision in many of these cases would undoubtedly be warranted, in order to secure the development desired.

15. A number of the extensions herein named lie partly or wholly outside of the jurisdiction of the city, as, for example, the Belt line around the waterfront, and the Presidio line. Special

means must therefore be found for the financing of these extensions, particularly the Belt line. But until the project is financed, arrangements should be made whereby The Embarcadero will be kept open for the building of such a service line *next to* the dock wall line.

16. The Van Ness Avenue line is largely a matter of municipal policy. Without tunnels it will unquestionably be needed, as it will become of great strategic importance in the event of failure to reach a resettlement of existing difficulties, when the organization of a complete competitive municipal system will be the principal means of relief.

17. It is probable that a number of the extensions recommended, especially those not in a direct line of through traffic, may be better handled for the present by means of a *shuttle service* rather than to attempt through service to the downtown district. On such lines, smaller car equipment would be permissible, such as would not be of sufficient capacity to warrant operating through the business district. And as shuttle cars can be readily operated on a *definite schedule* through the outlying districts, much better service results from transfer to a trunk line of frequent headway than to attempt a through service that will very likely be irregular at times, due to delays on the trunk line. Passengers then always have the opportunity of transferring to and from the *first* trunk line car passing.

18. Only one cable line extension is recommended, on Diamond Street, and this is unavoidable as it is now the most feasible way to reach the southern slopes of Noe Valley, unless a resubdivision of all the surrounding slopes with contour streets is put into effect.

19. In view of the completion of the Mission Viaduct an additional viaduct from Holly Street across the Islais Creek basin into University Mound district is not considered as of such pressing necessity for some years to come as the other extension projects herein outlined.

20. The opening of Berry Street and the improvement of Division Street as a continuation of Fourteenth for cross-town connection will become advisable in the very near future; also the utilization of Potrero and San Bruno Avenues as a low-level outlet from the district south of Market down the Peninsula.

21. The early improvement of Bernal Cut for handling through traffic from the converging thoroughfares is extremely important, and special plans have been made therefor.

22. A comparatively easy grade along Church Street has been devised by means of a short diversion at Mission Park and a

tunnel one block in length, which line reaches the heavily-settled Noe Valley district, now requiring additional service perhaps more than any other district in the city. This project is developed in detail in Chapter 12.

In conclusion, it is necessary to draw attention to the serious fact, with which the City is confronted, that *capital must be found* to build these extensions. The municipality, of course, has a free hand in this contemplated use of its streets; but many of the extensions are of such a fragmentary character that it is a grave question whether it should undertake, under present conditions, a capital burden of this nature. In approximate figures the following program of extension is to be undertaken:

	Miles	Cost†
Immediate	72	$5,730,000
After 5 years	48	3,820,000
Ultimate	21	1,710,000
Total	141	$11,260,000

The detailed routes to be established over these various extensions and the necessity therefor are developed in full in Chapter 7—Rerouting and Service Re-distribution. Similarly, street improvement work necessarv for the construction of these extensions will be analyzed in Chapter 12, Street Improvements.

This extension program does not contain possible future lines and extensions along contour streets that may be developed from resubdivision of hillside tracts now inaccessible because of prohibitive grades resulting from the rectilinear plan of subdivision. Unquestionably, such resubdivision will develop desirable additions to this program, and possibly some changes.

Inasmuch as the electors have expressed themselves (even though by a very small majority) against the execution of a plan of action such as contemplated in Charter Amendment No. 34, it is now incumbent upon the city:

1st. To finance, by local assessment or bond issue, all or a large part of the extensions herein called for, and secure the right of exchange of its own cars with the connecting United Railroads lines (involving an adjustment of wage scales); or

2nd. To build the roadbed only, and grant private operating rights there-over on a rental basis; or

3rd. To secure private capital to finance these extensions, under present charter conditions with the right of through service.

†Including only roadbed, overhead cars and power converting equipment; power purchased.

FIGURE 10—EXTENSIONS FOR COMPETITIVE MUNICIPAL SYSTEM.

Incorporating such extensions as will enable the City to develop territory at present largely unserved, and *eventually a complete system operating in direct competition* with the present private system. Herein the City is given the preference of unoccupied streets, and a few lines are included which parallel those of the present system in order to reach competitive territory. Much is dependent upon the validity of the five-block law, permitting the sharing of city streets by independent companies. The possible extensions available to private companies under this competitive plan are comparatively negligible. All these lines are detailed as to location, grades and routes in the report.

In Tables 10, 12, and 13 and Figs. 10 and 11 the unified plan originally proposed is segregated into its component parts for the purpose of indicating the real magnitude and legal perplexities of the problem, which the city is facing in establishing a *competitive* municipal system. In such a plan it is evident that duplication of investment and service will be inevitable, and the validity of the five-block law must be established.

The time has now arrived for the City of San Francisco to establish a definite transit policy; either to undertake a prolonged warfare of competition with established lines, or else to accept a reasonable compromise and subdivision of territory served between the municipal and private systems until such time as it is able to assume the financial burden of the entire transit system.

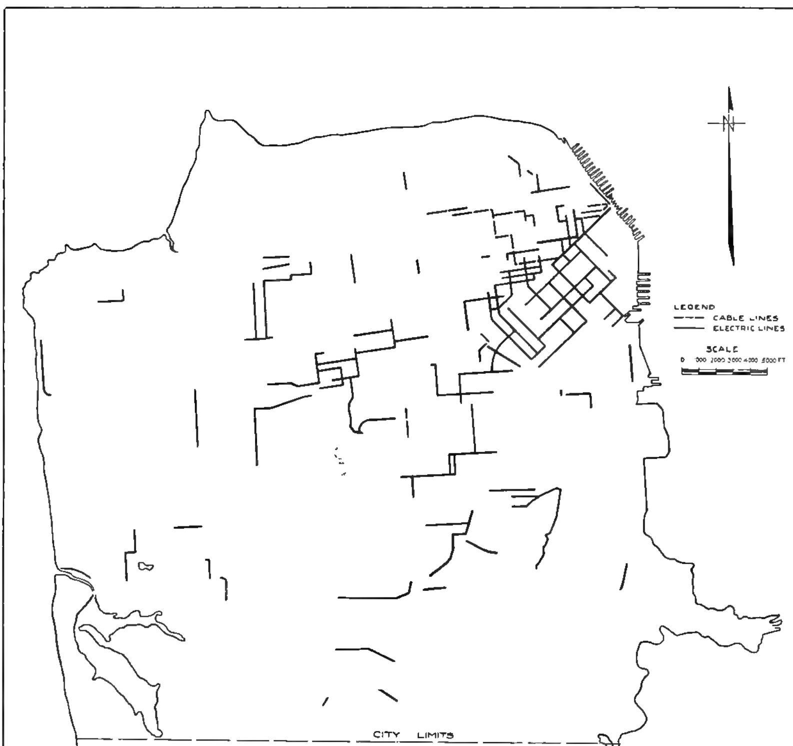

FIGURE 11 FIVE-BLOCK JOINT TRACKAGE STUDY.

Diagrammatic map indicating the extent of possible utilization of existing five-block sections of streets where the municipality is enabled to share with the present private lines in the obtaining of routing and terminal privileges under the "five-block" law. Some of these sections are used in the Municipal System Plan, Figure 10.

II. TRANSPORTATION FACILITIES FOR PANAMA-PACIFIC EXPOSITION AT HARBOR VIEW

In Chapter 10 recommendations are made for tunnels into Harbor View, and the discussion herein of transit plans is therefore presented from two standpoints:

(a) With tunnels;
(b) Without tunnels,

in order to make it perfectly clear that the tunnel propositions as recommended are not impracticable and unnecessary, but on the other hand are the only means of providing convenient access to Harbor View, and therefore essential to the financial success of the Exposition.

CONCLUSIONS AND RECOMMENDATIONS

1. With the *present* available transit facilities to Harbor View, only one important line—Polk Street—approaches reasonably near the Exposition; this terminal only reaching the concessions, being 5,300 feet from the main court and 10,500 feet from the drill grounds. The remaining lines are now so restricted in capacity that they may be almost neglected as an important factor in Exposition transportation, as the overload capacity is too limited or the walking distances too great.*

2. It is estimated that there will be 20 days of heavy travel in which the attendance will exceed 100,000 persons, and wherein the traction lines will be called upon to handle from 25,000 to 50,000 persons per hour—3 hours being allowed for transportation in one direction.

3. The proportionate distribution of traffic to the Exposition site is estimated to be as follows:

Main Exposition entrance	40%
Concessions entrance	20%
Water front	30%
Presidio Reservation	10%

However, on days of special field events in the drill grounds, the last named portion delivered to the Presidio would probably be increased to 20% at least. It is assumed that ample storage and

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* However, it is understood that an adequate intramural system of transportation by motor-busses will be provided within the grounds to supplement outside transportation for those willing to pay the extra fare; also, that a motor-bus line will be operated to the Exposition gates from various parts of the city.

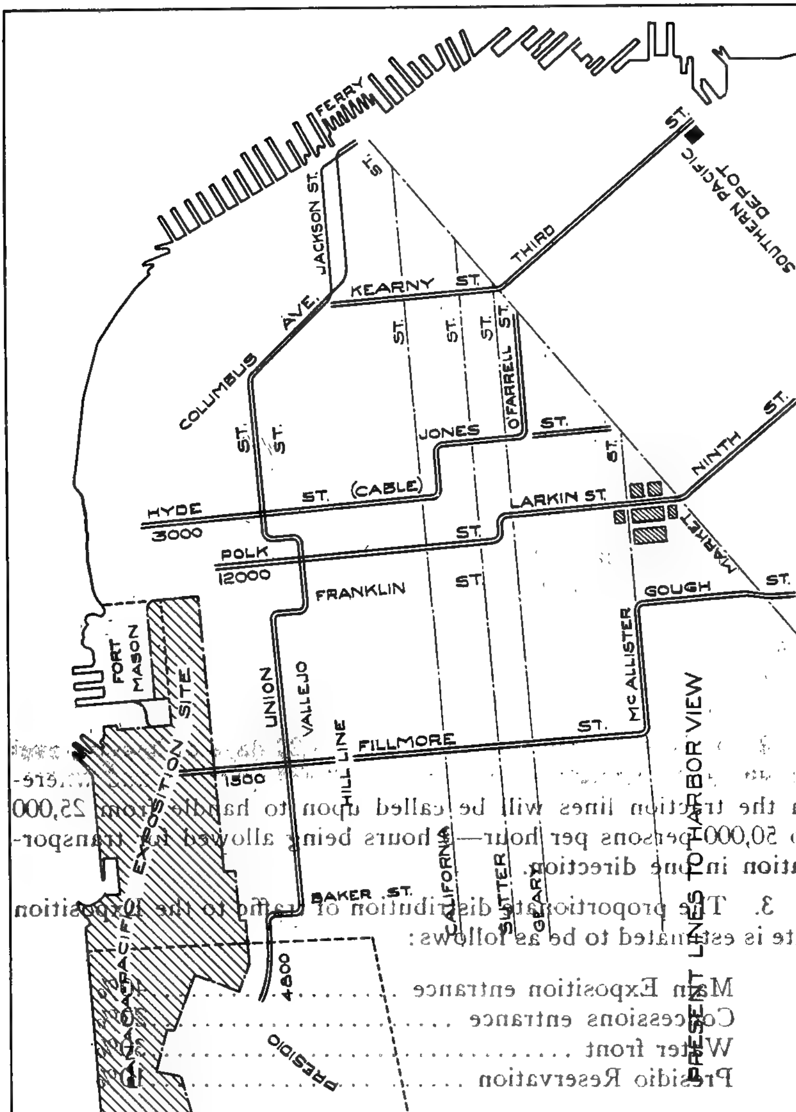


FIGURE 12—EXISTING LINES TO HARBOR VIEW.

Indicating their limited capacity, as at present operated and the serious difficulty of reaching the Exposition grounds without excessive walking. These lines are also shown in the contour map, Fig. 13.

reservoir loading capacity will be provided at each of these terminals proportioned to the volume of traffic handled.

4. The maximum safe carrying capacity of *present* lines reaching the Exposition is only about 37% of that necessary for the days of heaviest traffic, or 60% for days of medium traffic, and although sufficient as a total for the 268 days of normal traffic, a large proportion of the passengers cannot be delivered where desired—that is, to the Exposition proper.

5. The Polk Street line may be regarded as especially useful in serving the concessions, particularly during the evenings, but is not in any sense available for serving the main entrances, owing to the excessive walking distances.

6. Whatever additional lines are constructed should be so laid out as to be of maximum usefulness as a part of the traction system after the close of the Exposition, otherwise the duplication of investment will be unwarranted.

7. *With no tunnels available* there will be required double track electric lines of standard construction on Columbus and Bay Streets, The Embarcadero, Van Ness Avenue, Franklin-Broadway-Gough Streets, and Chestnut Street, with a low-level diversion of the Union Street line via Steiner and Greenwich Streets, in addition to the hill-top service. This results in a duplication of investment in trackage on Franklin Street, Van Ness Avenue and Polk Street respectively, which would otherwise be unwarranted for the needs of the near future. Moreover, a complete interchange of traffic between private and municipal lines will be necessary to secure sufficient flexibility in routing.

8. The Franklin-Broadway-Gough line cannot be regarded as desirable because of an unavoidable grade of 12.4%, but the line could be operated if necessary.

With the Franklin Street line eliminated and no provision for a loop terminal *within the Exposition* at the water front, the Exposition traffic cannot be handled adequately without one or more tunnels, as the congestion of cars and vehicles at the two principal entrances remaining would practically nullify the rapid operation necessary to realize the full capacity of the tributary lines.

9. *The Fort Mason tunnel* will not only be useful for freight handling prior to and after the Exposition, but is also exceptionally well located for passenger delivery to a loop terminal on the water front of the Exposition site, and after the Exposition will provide an important level thoroughfare to Har-

bor View for cars and vehicles during the day, and freight during the night. However, before the tunnel is built the present legal encumbrances to Beach Street should be entirely removed.

10. *The Fillmore Street tunnel,* of the three proposed tunnel entrances to Harbor View, will undoubtedly facilitate bulk passenger movement to the maximum extent by delivering promptly at the main Exposition entrance, with minimum interference with other lines. And this tunnel will be equally well located after the close of the Exposition, as the *only* available low-level route to Harbor View from the *Mission,* having a controlling grade of but 2.5%.

11. *The Broadway tunnel* will afford an effective entrance to Harbor View from the down town district. Supplementing as it does the Stockton Street tunnel by avoiding the detour otherwise necessary, the Broadway tunnel provides a much greater *flexibility* in routing of cars, consequently decreasing congestion due to their distribution over various available streets west of the Larkin Street portal.

12. The entire capacity of the Harbor View lines, present and proposed, has been considered as available for Exposition traffic, but it must not be forgotten that the normal business traffic of these lines must be handled in addition thereto. However, as the Exposition traffic will presumably occur during non-rush hours of city traffic and in an opposite direction, the interference of these two classes of service will not be so severe; but some increase in equipment will undoubtedly have to be reckoned with.

13. Owing to an unavoidable obstruction in Chestnut Street east of Fillmore, which prevents the widening of this main entrance thoroughfare to the Exposition at this point, ample provision for the storage of automobiles and the regulation of their movements must be made. With auto storage along Chestnut Street from Van Ness Avenue to Webster Street, much interference with passenger travel at the westerly terminus will be avoided; but this might well be supplemented by a pay storage close to the main entrance to the Exposition and on some lateral street not occupied by street cars, such as Scott or Pierce Streets.

14. In view of the demand for parking Van Ness Avenue, a design has been prepared for accommodating therewith a double track electric line with ornamental center pole electroliers which would combine utility and attractiveness, at the same time leaving an ample roadway width of 30 feet on either side without

reducing the present sidewalk widths. (Plate 18.) However, Van Ness Avenue need not be considered as necessary for street railway use if the tunnel program is carried through.

15. It is to be regretted that so much valuable time has elapsed in the execution of the tunnel program. And it must be apparent that should continued obstructions arise to prevent or delay the commencement of actual construction, the completion of the work within the short period intervening before the opening of the Exposition will become a physical impossibility. From the large tunnel traffic now contemplated, the adjacent property will receive the maximum benefit for many years to come. It is therefore a matter of most urgent necessity to adopt measures securing immediate action; otherwise surface lines will have to be depended upon entirely for Exposition service.

Finally, it must be apparent that under present franchise conditions stipulated by the Charter, no private capital may be expected to participate largely in any of the extensions outlined herein, however necessary. It is, therefore, essential that the municipality prepare itself to shoulder the entire financial burden of the railway extensions proposed herein, or similar ones.

GENERAL DISCUSSION

Available Transit Facilities. Harbor View exists today as a bottom land ten or twelve blocks in width and fourteen blocks in length, excluding the Presidio Reservation, or perhaps double this area including the Presidio, the bottom lands extending from Van Ness Avenue nearly to Fort Point, or practically in a line with Tenth Avenue (Fig. 13). It is completely shut in upon the south and west by Pacific Heights and the succeeding ranges of hills and the Presidio Hills, with the single exception of one important boulevard—Van Ness Avenue—which, however, has a maximum grade of from 9 to 10 per cent on the slopes approaching the saddle between Nob Hill and Lafayette Square. The ascending grades of this entire enclosing range are entirely too steep for normal surface traction, running as high as 25 to 30 per cent, except for a winding entrance through the Presidio Reservation with a maximum grade of 10 per cent. To the east the Harbor View bottom lands adjoin the level tract known as North Beach, with a fairly easy approach grade over the saddle between Fort Mason and Russian Hill. It is therefore clear that the only avenues of entrance to Harbor View for surface traction lines are as follows:

FIGURE 13—CONTOUR MAP OF HARBOR VIEW DISTRICT.

Outlining Panama-Pacific Exposition grounds, and the natural avenues of approach as determined by the surrounding contours, with all practicable service lines and terminals, irrespective of ownership. The locations of proposed tunnels as recommended, emphasize the additional entrance facilities to Harbor View resulting therefrom. Distances from center of main court indicated by mile circles.

1st—Northerly, across the Van Ness Avenue saddle, or adjacent streets.

2d—Westerly, across the Bay Street saddle.

3d—By contour route through the Presidio, entering in the vicinity of Presidio Heights.

4th—By ferry.

Unlimited access is, of course, possible to Harbor View by Ferry, but the maximum utility for such an entrance would be available for transbay passengers only, and not for San Franciscans, who would then be obliged to go to the present Ferry and transfer by boat to Harbor View. While this would be attractive in some respects, it is inconceivable that it would become an avenue of transportation which would be used extensively and considered as convenient as surface car lines reaching Harbor View directly from various parts of the City, even if the extra fare that would be charged were neglected. In the latest Exposition plan, ferry slips are provided for at the foot of Webster Street.

Existing surface car transportation to Harbor View is limited at present to four lines, listed in the order of their importance and carrying capacity, as follows:

1. Polk Street Line, now terminating at Lombard Street, but capable of being extended as far as Bay Street under the same franchise conditions as the main line, when the regrading of Polk Street, now under way, has been carried out. This Bay Street terminus will not reach directly any portion of the Fair grounds. On the other hand, it is 5,300 feet from the center of the Exposition tract, and 10,500 feet from the center of the drill grounds. Moreover, there is no entrance provided opposite Bay Street, the nearest being the concessions entrance at Francisco Street, which would require a walk of approximately 3,200 feet through the concessions to reach the nearest entrance to the main Exposition tract. Such a line ending in a main thoroughfare would provide for the development of no terminal storage capacity other than a double cross-over, which would permit only about half the capacity of the tracks to be utilized.

2. Union Street Line, which reverts to the control of the City in 1913 by virtue of the expiration of the franchise. This line reaches the Exposition proper via Baker Street, and also via the extension into the Presidio. However, as now operated, it serves no useful purpose for direct transportation from other parts of the City except the Ferry. Although transfers between Union Street and the United Railroads lines are now in force,

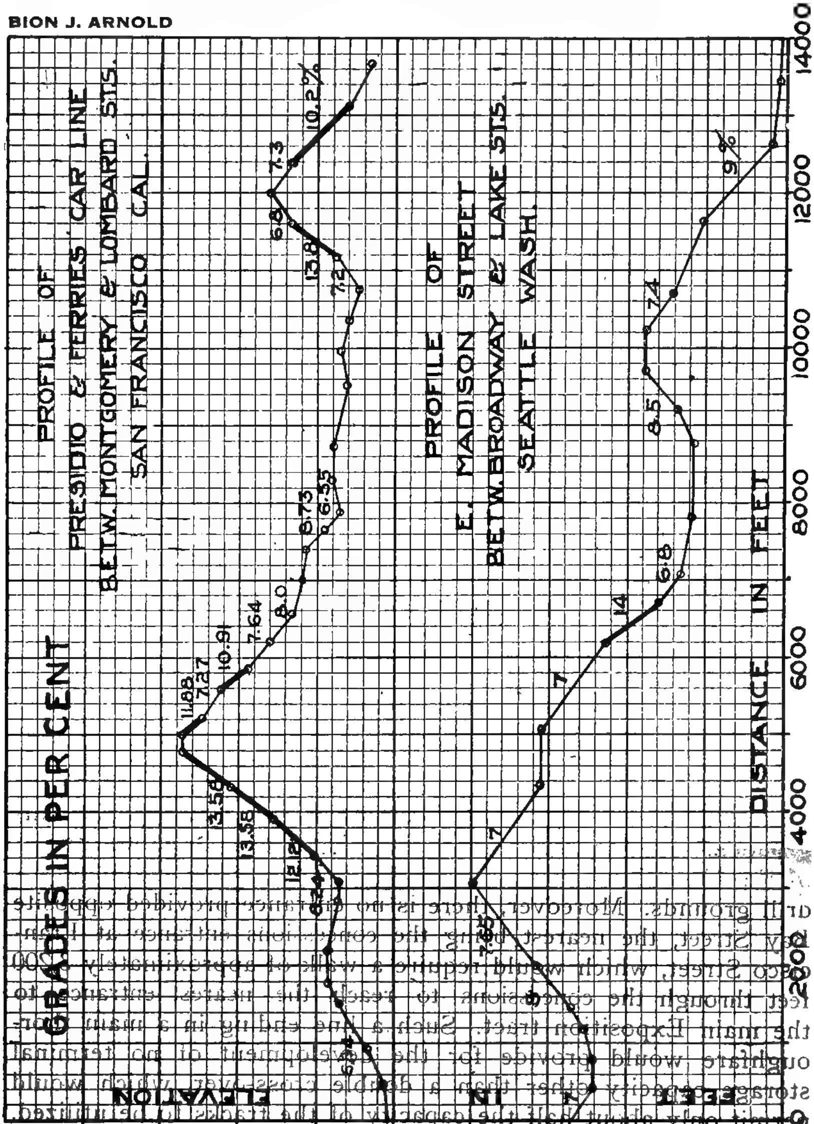


FIGURE 14—PROFILE OF PRESIDIO AND FERRIES (UNION STREET) LINE,

Showing the severe grades encountered (nearly 14%) and the consequent impossibility of using it as an important feeder. Comparison with profile of East Madison Street line, Seattle, Washington. A special type of car is recommended for this and similar lines.

these transfer facilities will presumably expire when the line is taken over by the City in 1913. The Union Street line is furthermore operated under the handicap of excessive grades, as shown by the accompanying profile (Fig. 14), in which the grades are indicated. There are three blocks on the line 13.6%, 13.6% and 13.8% respectively, which represents the worst operating condition in the city from the standpoint of heavy electric transit with normal equipment. Moreover, a diversion of four blocks from the original route was necessary at the time the line was electrified, in order to avoid the excessive grade of 18.9% in Union Street.

On the western section of the Union Street line the heavy grades may be avoided by locating a new low-level route via Steiner and Greenwich Streets, connecting at Baker Street with the existing Presidio line. This need not result in any diminution of the present hill top service, but if this divergence were constructed the capacity of the Union Street line in Harbor View, in connection with any of the Van Ness valley or Broadway tunnel lines, would be greatly increased, and would offer the *only means* of reaching the western portion of the Exposition site; for standard double track equipment could then be operated thereon within two blocks of the main Exposition entrance, and directly into the Presidio.

Possible extensions from the Presidio terminal of the Union Street line are shown in Fig. 13. The westerly extension as far as the new location of the barracks may be considered as an immediate necessity, and a further extension to the Fort Point terminus would provide an attractive scenic line, for which there seems to be much demand. The southerly connections to Presidio Avenue and Cherry Street are not so necessary, except that a convenient entrance to Harbor View from the Presidio Heights and Richmond would thus be afforded.

3. *Hyde Street Cable Line.* This line reaches the center of the city effectively, but is of limited capacity and terminates at North Point Street, three blocks from the concessions district, being 6,250 feet from the center of the Exposition and 11,450 feet from the center of the drill grounds.

4. *Fillmore Street Balanced Cable Way.* Except for the excessive grade, this would constitute a most direct entrance from the city to the Exposition proper. However, two blocks of approximately 25% grade operate to reduce its capacity to an inconsiderable point, due to the delay and inconvenience necessitated by the use of a balanced cable way on the northern slopes.

Estimated Traffic.* The Panama-Pacific Exposition will open February 20th and close December 4th, 1915, a period of 288 days, including Sundays. It is estimated that the average attendance, including heavy and light days, will approximate 30,000 persons per day, this average being based upon the ratio between attendance and district population which has developed from experience with previous expositions held in this country.

Within this period there will be two special days in which the maximum traffic will presumably be encountered, and every means of transportation impressed into service to its utmost capacity, viz., "San Francisco Day" and "Admission Day." On these days it is anticipated that at least 250,000 people will be in attendance, of which it is estimated that two-thirds, or 167,000, will be handled by the street railways and other vehicles; one-third, or 83,000 people, being delivered by water. (This is approximately the same amount of traffic as is at present handled per day by the transbay ferry service to and from San Francisco by the two principal suburban systems.)

In addition, it is estimated that there will be seven days with attendance of 150,000 or over, and eleven days of 100,000 or over. The average attendance for the remaining 268 days will be about 21,000 per day.

The daily and hourly fluctuation of Exposition attendance during a normal week, based upon previous experience, is considerable, and as near as can be estimated from available data, *excluding water-borne traffic,* the surface transportation facilities of San Francisco will be called upon to handle a maximum traffic during these heavy week day periods of *50,000 passengers† per hour,* excluding the two special days of maximum attendance above noted. In this connection it is reported that maximum exposition attendance per day has been recorded as follows:

Philadelphia, 1876	275,000
Chicago, 1893	760,000
St. Louis, 1904	405,000
Seattle, 1909	200,000

Assuming arbitrarily one-third of the traffic to be water-borne, the income from an average daily attendance of 30,000 would be $2,000 a day, or $576,000 for the entire period. The water-borne traffic, on a basis of a 10-cent fare, would then derive practically

* Based upon information obtained from the Exposition officials.

† Should later developments indicate that this maximum is somewhat high the headway of tributary lines may be reduced proportionately. But practically the same trackage will be required unless the maximum demand falls below 38,000 per hour or thereabouts.

the same total daily income from the Exposition traffic that the street railways would derive from the remaining two-thirds on a 5-cent fare basis (assuming adequate transfer privileges).†

These figures do not consider traffic carried by automobiles and motor busses, for the reason that the volume of traffic carried by private machines would be inconsiderable, and that of public conveyances would probably also be limited because of the higher fare charged. However, if adequate street railway facilities are not available, motor busses will have to be relied upon for a considerable share of land traffic.

Development of Additional Facilities

Thoroughfares. In the planning of new car lines and estimating their capacity, it is useless to figure upon the *absolute maximum* capacity of a street railway line along a level thoroughfare and unencumbered by vehicle traffic. The City of San Francisco must face a two-fold problem of its grades and its narrow streets, for all of the streets in the 50-vara district and Western Addition which lead to the Exposition grounds are too narrow, with the present width of sidewalks, to provide for *two lines* of vehicles between the curb and the street car—with one exception, Van Ness Avenue—although some progress has been made toward reducing the width of the sidewalks on important streets such as Polk Street and Sutter Street. And inasmuch as any attempt to select low-grade routes for street railway lines will also result in the selection of these same routes for Exposition vehicle traffic, it is evident that the existing thoroughfares available will be crowded to their utmost, and maximum schedule speed will be impossible to maintain.

Safety Factor. The safety of passengers, especially under heavy traffic conditions, dictates that some limit be placed upon car operation on heavy grades, and in this respect a fixed assumption has been made, viz., that on grades of more than 8%, more than one car will not be allowed between successive street plateaus. This limitation will evidently reduce the capacity of the line, but it is considered essential under the abnormal conditions attending Exposition service, and it is, in fact, the standard which the United Railroads at present endeavors to work to in its hill lines. And it is further assumed that on grades up to 8% or 10%, power will be applied with full parallel position on the controller, and possibly full parallel may have to be resorted

†If adequate service by water is not to be available, as later developments indicate, then every facility for distribution from the Ferry must be provided, especially the Broadway and Ft. Mason tunnels and The Embarcadero.

to on still steeper grades, in order to increase the capacity of the line, which would necessitate equipment having ample motive power.

The effect of grades upon average schedule speed under specified conditions of running will be apparent from the fact that a decrease in grade of from 10% to 4% will result in an increase of schedule speed of over 25% with the same equipment. Within these reasonable grade limitations, it is found that, neglecting the increased power consumption, which cannot be avoided, the above safety factor of one car per block will not introduce an excessive element of delay in the schedule by reason of the fact that the spacing of cars under this arrangement results practically in the same headway as corresponds to maximum capacity operating on the level. Thus, with a schedule speed of 8 miles per hour, the elapsed time in running one block is from 29 to 41 seconds, according to the length of the block. Therefore, this represents the minimum headway permissible along the entire route.

Headway. A study of minimum headway, *i. e.*, maximum line capacity, shows that only under relatively low schedule speed can the maximum number of cars be passed by a given point. This minimum headway exclusive of vehicle traffic obstruction, is about 22 seconds, or approximately 163 cars per hour (as compared to 127 cars per hour now on Market Street), but the resulting schedule speed would be so low as to be impracticable. This means that it is not possible to utilize a surface railway track to its full capacity if rapid transit is desired.

On the level it is probable that a 30-second headway will be the lowest limit that can be maintained with the high average speed desired, especially in view of the probable traffic obstruction. This figure has been used in capacity estimates.

Carrying Capacity. The permissible carrying capacity of a standard 44-seat car is purely a matter of judgment and liberality. It is a fact, however, that expensive equipment would not be warranted for handling occasional maximum loads, and for such traffic as the Exposition offers, a somewhat higher loading might be permissible than for regular urban traffic. This capacity, which provides for 127% excess or standing load, has been taken as 100 persons for basic estimates, representing a compromise between normal and emergency maximum for the various types of double-truck cars.† On the Fillmore and Union Street

†This assignment of 100 persons per car refers to the average load during the hour. Individual cars would unquestionably carry higher loads, especially at transfer points.

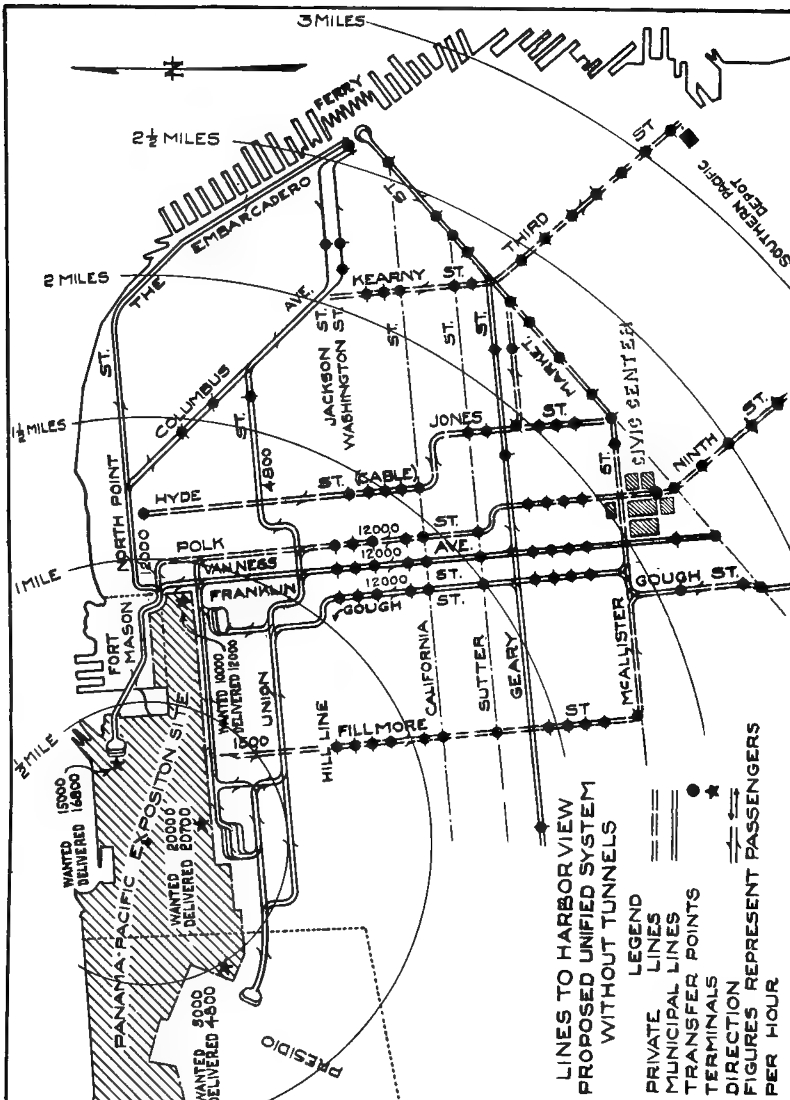


FIGURE 15 —UNIFIED TRACKAGE PLAN (WITHOUT TUNNELS.)

Showing individual lines recommended using various avenues of entrance, with available transfer lines. This map indicates all possible transit developments without the use of tunnels. Both private and municipal lines are represented, with the net capacity of each throat and terminal, all based upon the estimated traffic demand of 50,000 people per hour.

hill lines, lighter equipment would be used, so that a carrying capacity on these lines of 60 persons is assumed.

On the cable lines, the capacity is further limited by the permissible loading of the cable, and a headway much closer than 2 minutes, or 30 cars per hour, probably could not be safely figured on.

Line Capacity Without Tunnels. For the present system, and assuming the above unit capacities, the total possibilities of transportation by surface car lines reaching Harbor View directly under *present* conditions are 18,300 passengers per hour.* This might be exceeded under the heaviest traffic conditions, but not without serious inconvenience and increased danger on the hill lines. This capacity is but 37% of the estimated requirements.

The estimated capacity of the *proposed* system *without* tunnels, shown on Fig. 15, is 54,300 per hour. But this includes lines on both Franklin Street and Van Ness Avenue, also on The Embarcadero and Columbus Avenue via North Point Street, Van Ness Avenue, Beach Street and thence through the Fort Mason Reservation, communicating with the Exposition waterfront terminal.

For Van Ness Avenue, the central parking plan shown in Plate 18 would permit the use of either permanent or temporary track construction.

Line Capacity With Tunnels. For the system with tunnels, as shown in Fig. 16, the estimated capacity is also 54,300 per hour.** But with the tunnels constructed, no new line on Franklin Street will be required except four blocks from Union Street to the Concessions terminal on Chestnut Street. This line may be removed after the close of the Exposition. Likewise, no line on Van Ness Avenue will be required except three blocks from Broadway to Union Street.

Trailers. On the comparatively level tunnel routes, trailers might be considered to increase their capacity. In this case the headway *per car* could be considerably decreased. However, the use of trailers would be at variance with the operating standard established in San Francisco, and consequently their use has not been considered in the capacity estimates herein. For hill operation no trailer should be permitted without motors operated from the master control of the motor car.

Distributing Trunk Thoroughfares. The final plan of the Exposition grounds shows that Chestnut Street and Van Ness

* Hyde Street must be omitted from this computation owing to the excessive walking distances involved.

** If box cars are used on the Polk Street line, this total capacity would be increased 8%.

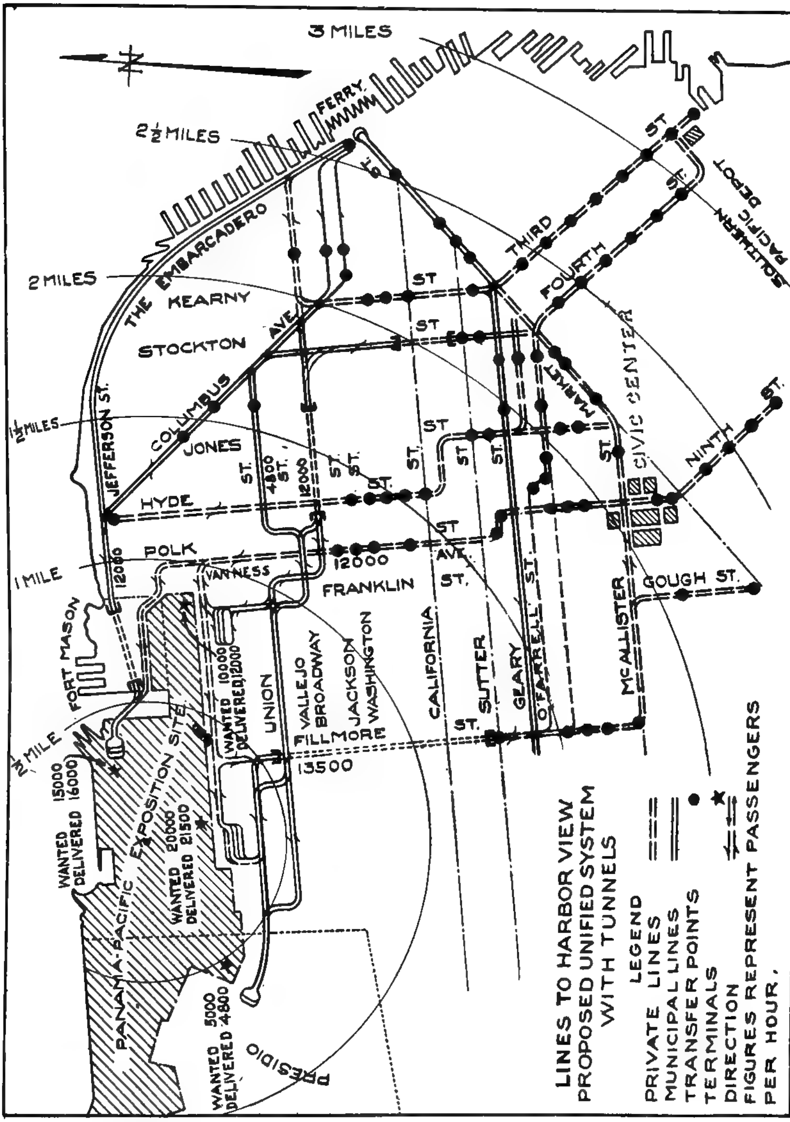


FIGURE 16—UNIFIED TRACKAGE PLAN (WITH TUNNELS.)

Showing individual lines using various avenues of entrance, with available transfer facilities. This map indicates recommended transit assuming the use of tunnels. Note improved distribution of traffic. Franklin and Van Ness lines are here eliminated, as they are unnecessary with tunnels also.

Avenue will handle the great majority of Exposition traffic, owing to the location of all entrances thereon, with the exception of trans-bay traffic and that entering through the Presidio grounds. Van Ness Avenue, having a width of 125 feet, is fortunately ample for the accommodation of both railways and pleasure vehicles; four lines of automobiles on either side of the centrally located railway tracks can be accommodated. And from Van Ness Avenue several east-west distributing streets are available by way of which various parts of the Exposition grounds can be reached.

Chestnut Street, however, is only 68 feet 9 inches in width, which with 15-foot sidewalks gives a roadway width of only 38 feet 9 inches, and with 12-foot sidewalks, a roadway of 44 feet 9 inches. Inasmuch as the present standard track and car construction requires a total over-all width of 20 feet 2½ inches with the wider cars, or 18 feet 8 inches for the narrower Chicago standard, it follows that there will not be sufficient room for the accommodation of *two lines of vehicle traffic on either side* of the car line, unless sidewalks are reduced to about 11 feet. While Chestnut Street will be widened for auto stands from Van Ness Avenue to Fillmore Street, a large gas holder just east of Fillmore Street prevents the widening of the roadway at this point. On account of this constriction at one of the important Exposition entrances, it will probably be necessary to establish fixed stopping points on Chestnut Street so as to prevent the massing of cars and passengers at this throat. Such stops are indicated on the block plan, Fig 17, herein.

Terminals. The question of terminal facilities for surface lines is one of the greatest importance, for without proper facilities the available capacity of the tributary lines cannot be realized. Moreover, if passengers cannot be delivered directly and conveniently into the Exposition grounds, the adoption of other means of transportation at probably higher rates of fare will be forced.

The final layout of the Exposition plans shows entrances as follows:

(1) Scott Street at Chestnut—main entrance to central court.

(2) Fillmore Street at Chestnut—first lateral distributing thoroughfare entering the main group of buildings.

(3) Francisco Street at Van Ness Avenue—easterly entrance to concessions, and an important night entrance.

(4) Presidio entrance—terminus of the present Union Street electric line.

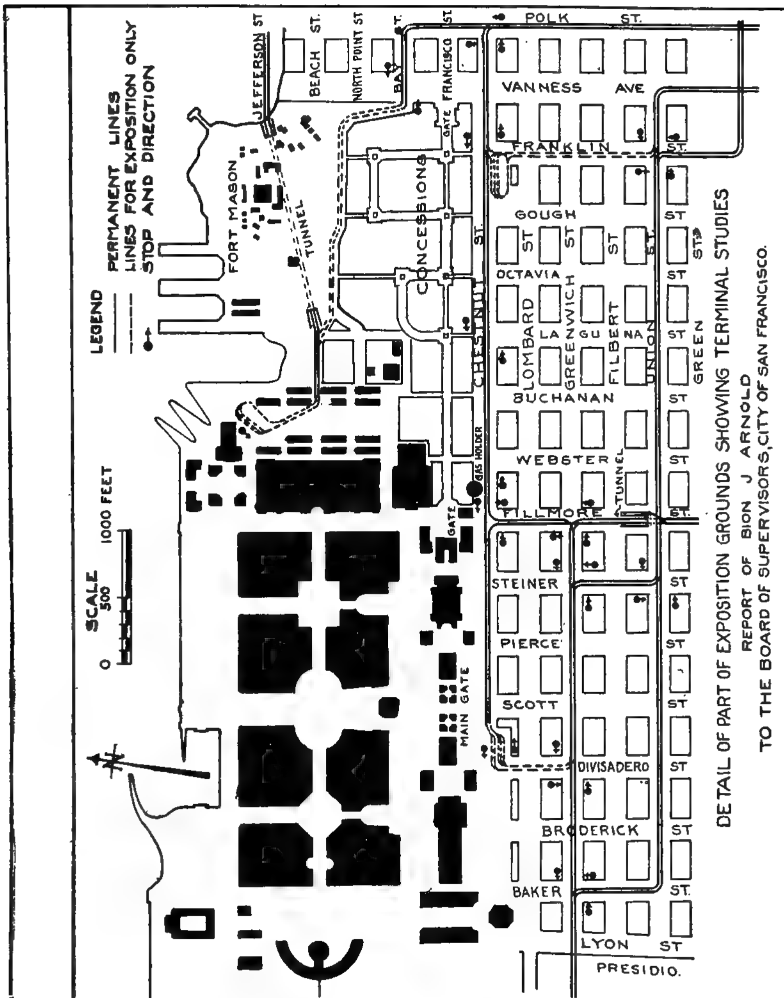


FIGURE 17.—DETAIL OF EXPOSITION TERMINALS PLAN.

Showing entrances and terminal studies. Full lines represent routes best suited for effective use after the Exposition; dotted lines represent those designed for handling Exposition traffic only. Recommended stops also indicated. Note the obstruction in Chestnut Street caused by the present gas-holder at Fillmore Street. All these terminals are very necessary, especially that on the water front.

(5) Ferry slips at the foot of Webster Street, and reaching directly the main longitudinal water front thoroughfare leading west to the drill grounds.

At the present time it appears that Chestnut Street will be forced to carry the great majority of street car traffic destined for the central building group, for the Van Ness Avenue entrance will not be desirable except for those wishing to use the tortuous entrance way through the concessions. And without suitable reservoir terminals, Chestnut Street would be unable to handle the v lume of traffic anticipated. *A surface car terminal on the Exposition water front* is, therefore, desirable and necessary.

Available Sites. An excellent site for such a terminal loop may be found near the main ferry slips at the foot of Webster Street, as indicated in Fig 17. This, however, will require an entrance from Bay Street and Van Ness Avenue, across Fort Mason and one block of private property which is now largely a water lot.* This leads to a position north of a tract which has been reserved for railroad yards, and the south wing of the Ferry Plaza structure at this point could then be effectively utilized for street railway terminal gates. It is also possible that some of this railroad yard trackage could be utilized as reservoir capacity for surface cars at times of unusual demand.

This terminal location would then deliver passengers from the most important lines (other than those using the Fillmore tunnel) directly into the North Esplanade, which parallels the water front for the entire length of the Exposition grounds. Incidentally, such a route would provide much-needed service to the Fort Mason Reservation and to the United States transport docks, located at the foot of Laguna Street, which will be needed before and during the Exposition. This terminal should be jointly available for all surface lines approaching the Exposition at the northeast corner, including Van Ness Avenue, Polk Street, North Point Street, and all lines running through Fort Mason tunnel.

In addition to the above-mentioned inside loop terminal, there are three locations along Chestnut Street available for outside loops:

(1) Between Franklin and Gough Streets.
(2) Between Steiner and Pierce Streets.
(3) Between Divisadero and Scott Streets.

The first may be effectively utilized as the entrance to the concessions for which a supplemental entrance is contemplated in addition to the Van Ness Avenue entrance.

* Or Beach Street, from Laguna to Buchanan, might be used for this purpose without entering private property.

The third terminal site at Divisadero is an excellent location for serving the main bulk of the traffic at the principal Exposition entrance. With this terminal, one at Steiner Street would probably be unnecessary. Although a separate loop would be exceedingly useful as a terminal for the Fillmore tunnel lines, the fact that Lombard Street is reserved as a military highway makes the Steiner Street site unavailable.

With three terminals, traffic will probably be distributed as follows:

(1) Exposition loop, Fort Mason, 15,000 per hour, maximum.
(2) Franklin Street loop, 10,000 per hour, maximum.
(3) Divisadero Street loop, 20,000 per hour, maximum.
(4) Presidio terminal, normal, 5,000 per hour, maximum.
Presidio terminal, on field days, 10,000 per hour, maximum.

Distribution of Capacity. With the above distribution of terminal traffic, the probable traffic of each of the tributary lines is presented in the appended Table 15, together with the maximum capacity of these "feeder lines" that could be realized if an unobstructed entrance could be found. These capacities are computed with a view to the limitations of safety and power previously discussed.

The detailed routes which will be necessary to provide effective terminal facilities as above outlined are listed in the Tables 16 and 17.

Platform Arrangement. All of these loop terminals may be designed with surface tracks and platforms, but to properly expedite unloading and loading, separate car berths should be provided with passenger concourse between—otherwise on days of heavy travel serious interference in passenger flow will result. In the case of the Divisadero terminal, where five loop tracks may be necessary, a sub-concourse from Chestnut Street should be built leading to the three rear tracks directly, without necessitating the crossing of the two front tracks.

It will also be desirable to install prepayment entrances at these platforms, to avoid the delay of loading cars in the usual manner. Thus, the Divisadero terminal is divided into separate platforms for the use of United Railroads lines and for the Municipal lines, respectively. Separate loops may similarly be used at the inside Exposition loop. Or if a proper basis of accounting could be devised by means of registered entries to the respective lines, a common prepayment entrance would be most convenient and efficient.

Track Centers. In order to realize the maximum capacity from the Exposition surface lines, it will be necessary to so design track and special work that cars may pass on curves without mutual obstruction due to the overhang of platform or fenders, otherwise the delays due to traffic obstruction at street intersections will become serious. On the present long-platform cars, the overhang of the fenders as now used is so great as to require wide curve separation, but clearance on curves is so important that if necessary, curbs should be cut back to avoid the overhang of car bodies when rounding the inside curve. And on these narrow streets of the Western Addition traffic regulations must be rigidly enforced preventing street vehicles from standing or passing so near a street corner as to come within the range of the sweep of a fender or platform.

It is also important that a "devil strip" of at least 20 inches should be provided between cars, owing to the unavoidable possibility of pedestrians being caught between cars. Where the standard Municipal Railway cars only are to be operated, which cars are 8 feet 6 inches in width over all, straight double track may be laid with centers 10 feet 2 inches apart; but where the present wider rolling stock of the United Railroads is to be operated the tracks must be laid with a center line distance of 11 feet ½ inch, in order to provide the necessary "devil strip." However, if, on such lines of common usage, all cars will be of the narrower standard width of 8 feet 6 inches, the narrower track centers should be laid, thus conserving to the greatest possible extent the remaining roadway and sidewalk widths.

Franchise Requirements. In order to carry out *any* of the improvements herein specified, it will be necessary for franchises to be granted either on a permanent or a revocable basis. It is probable that the Chestnut Street lines could be well utilized in the future, after the expiration of the Exposition. The route across Fort Mason, however, is only granted by the Government on a revocable permit, excepting via the Fort Mason tunnel, which would be of permanent utility. Any extensions through the Presidio should also be located so as to be of permanent value, as otherwise the investment would hardly be justified. It is, therefore, clear that two methods are open to the City for obtaining these service extensions:

(1) To build municipal lines, and grant operating rights over them to the United Railroads on a rental basis:

(2) To issue permits or grant some form of indeterminate franchise to the Corporation for those lines which the Municipality does not care to build.

The latter plan involves for the Corporation radical changes in its operating and financial organization, owing to the stringent Charter provisions now regulating extensions, which condition must be met by the City by special legislation.

III—RAPID TRANSIT PLANS

While no study of transit facilities would be complete without some estimate of the needs and possibilities of rapid transit by subway or elevated, it is believed that it is still too early to contemplate the building of a comprehensive subway system for San Francisco, owing to the comparative absence of very long hauls, and especially if the tunnel and other transit improvement projects herein discussed are carried out. These projects will very likely develop in the following chronological order:

1. Car and traffic tunnels for the Western Addition as already recommended.

2. Market Street extension rapid transit tunnel under Twin Peaks for suburban and interurban service as recommended.

3. Mission-Sunset tunnel from Market Street extension to Pope Valley and upper Sunset, to be built two-level so as to connect with future Market Street subways as recommended.

4. Electrification of present railroad outlet through the Mission for both city and suburban rapid transit systems (via Southern Pacific, Ocean Shore, or both).

5. Market Street subway connecting with the Twin Peaks tunnel: (a) Southern branch through the Mission connecting into Bernal Cut with the suburban electrification; (b) East Richmond branch, preferably following McAllister Street or Golden Gate Avenue and touching the Park.

Additional branches will then follow in due course—into West Richmond and the Western Addition by Point Lobos Avenue to the west, and by Divisadero Street to the north, with possibly a downtown cross-town line via Third, Kearny, and Columbus, through Fort Mason tunnel into Harbor View. This Richmond branch can reach Point Lobos Avenue from Golden Gate Avenue by a diagonal, deep-level cut across what is now Laurel Hill Cemetery, and similar use may possibly be made of Jefferson Square and Alamo Square. For the latter, the combined traffic-transit tunnel as designed for the Mission-Sunset tunnel is appropriate. (See Figs. 66, 67 and 68.)

Of these subways, the Market Street trunk and Mission branch will probably become the first necessity; and if the City de-

cides to build the Twin Peaks tunnel now as far as Valencia Street, the remaining subway construction will undoubtedly be hastened.

Elevated Railways. The construction of an elevated trunk line through the heart of the business district at this stage of transit development would appear to be exceedingly questionable for three reasons: (a) The imperative necessity of rapid transit in Market street, due to the peculiar street layout; (b) the inadvisability of obstructing traffic in so important a street as Mission by elevated posts; and (c) the decided tendency in modern rapid transit development to depart from elevated construction within the business district in favor of subways, owing to the avoidance of noise, extra climb, and inconvenience to abutting property.

It is hardly probable for some years to come that Market Street traffic could be induced much further south than Mission Street. But even if possible, only one route exists—Minna Street, just south of Mission—that might reasonably be developed as an elevated entrance. Minna Street, hardly more than an alley, stops at First Street, requiring six blocks more right-of-way to reach the Ferry, in addition to further acquisition of property near the "Hub." This route would be of maximum usefulness if the Twin Peaks tunnel is built no further than Eureka or Castro Streets, in which case tunnel cars after reaching the Market Street hump could then divert into McCoppin Street (which descends rapidly at this point) crossing overhead at Valencia Street and extending as a practically level connection with the elevated line in Minna Street. As this street is only 35 to 40 feet in width, the elevated structure would have to span the street from curb to curb; and if constructed with cushioned roadbed, the objectionable noise could be minimized, although the light in all abutting buildings would be practically cut off.

This elevated line cannot, therefore, be considered as in any sense a *solution* of the present rapid transit problem of San Francisco, and merely provides a double-deck street entrance to the business district for tunnel lines. Only two tracks can possibly be accommodated, and the line will become practically of secondary use only for passenger transportation as soon as the Market Street subway is constructed. However, it might be used advantageously for light freight and express delivery into the upper floors of the abutting buildings provided with proper transfer facilities. As this phase of the railway business is now developing rapidly from necessity (as in Los Angeles, for example), this lends perhaps a more important aspect to an elevated

railroad in Minna Street than its ultimate value for passenger transit. Until a comprehensive subway system is warranted, which will be sooner in San Francisco than in most cities, the surface traction system should be improved and perfected to the maximum possible extent.

Existing Rights-of-way. The utilization of the Southern Pacific and Ocean Shore Railroad rights-of-way for suburban electric service is directly in line with the economic policy of maximum use of idle investment. While the exact basis of interchange of operating rights between City and Company is, of course, a matter for negotiation, both these low-level rights-of-way are capable of development as rapid transit trunk lines, from which outlying sections may be in turn developed by a system of local street railway feeders. Fortunately, the franchise of the Ocean Shore Railroad specifically encourages this development (Ordinance No. 40, New Series), and those of the Southern Pacific appear to be so fragmentary as to debar it from using the old Mission entrance through Bernal Cut and Harrison Street without the City's consent. This, of course, is no cause for abandonment or confiscation; for a low-grade entrance developed at such heavy cost becomes a valuable asset to the City by joint utilization for rapid transit purposes.

Both the Southern Pacific and Ocean Shore rights-of-way reach conveniently a territory which is difficult, if not impossible, to serve directly by surface traction lines; and both can be of immediate use in connection with present traction developments. If the Southern Pacific line is given over entirely to electric service, as it should be, this will be much superior to attempting to use city streets for trunk line service—a plan which is already meeting with objection in trans-bay cities.

The Ocean Shore line conforms well to the plans proposed herein for reaching the large University Mound district. But for maximum convenience of connection with a line on Van Ness Avenue, this thoroughfare should be extended to Mission and Twelfth Streets—shown in Fig. 19—as recommended.

For long-distance train service down the Peninsula, the eventual electrification of the Bay Shore tunnel route would appear to be far superior than by attempting to develop exclusively for this particular traffic the old Mission right-of-way, with its physical obstructions, higher grades, and circuitous routes. This Mission route therefore becomes of maximum present usefulness in developing the immediate suburbs, as in the case of the Southern Pacific and Key Route lines across the Bay.

On the other hand, the Twin Peaks tunnel forms the logical route for rapid electric train service to the near-lying territory south of the County line. And as this tunnel will presumably be open to private transportation lines on a rental basis, it is possible that it will become a factor in further developing those western slopes of the Peninsula now reached only by the Ocean Shore, but still comparatively inaccessible for resident commuters by reason of time consumed in transit and difficult terminal entrance. It thus appears that by general *readjustment* of transportation facilities, present and proposed, a much more logical system of trunks and feeders may be worked out, which will at least double the present habitable areas lying within the 30-minute time zone *for local suburban service,* and extend it perhaps four or five times beyond the present limits *for interurban train service,* as exemplified in the trans-bay electric development.

Bernal Cut. In the joint development of Bernal Cut and Circular Avenue, the elevation or depression of the present tracks

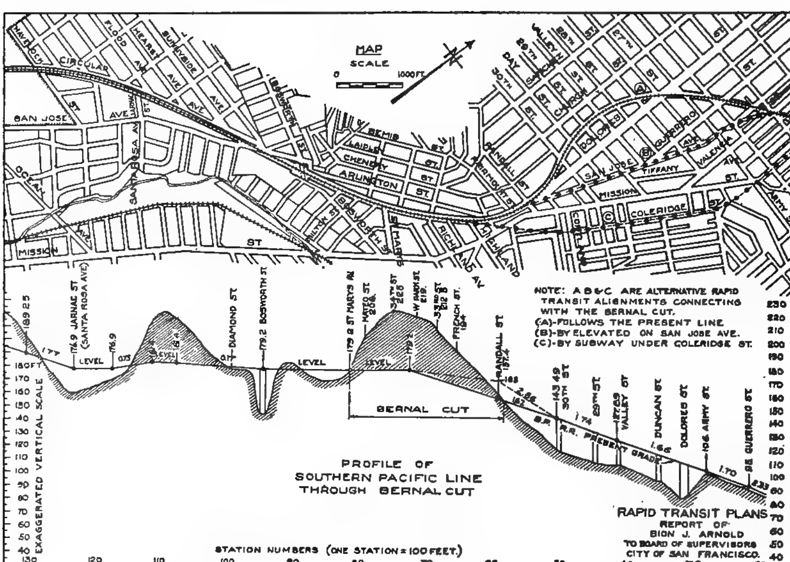
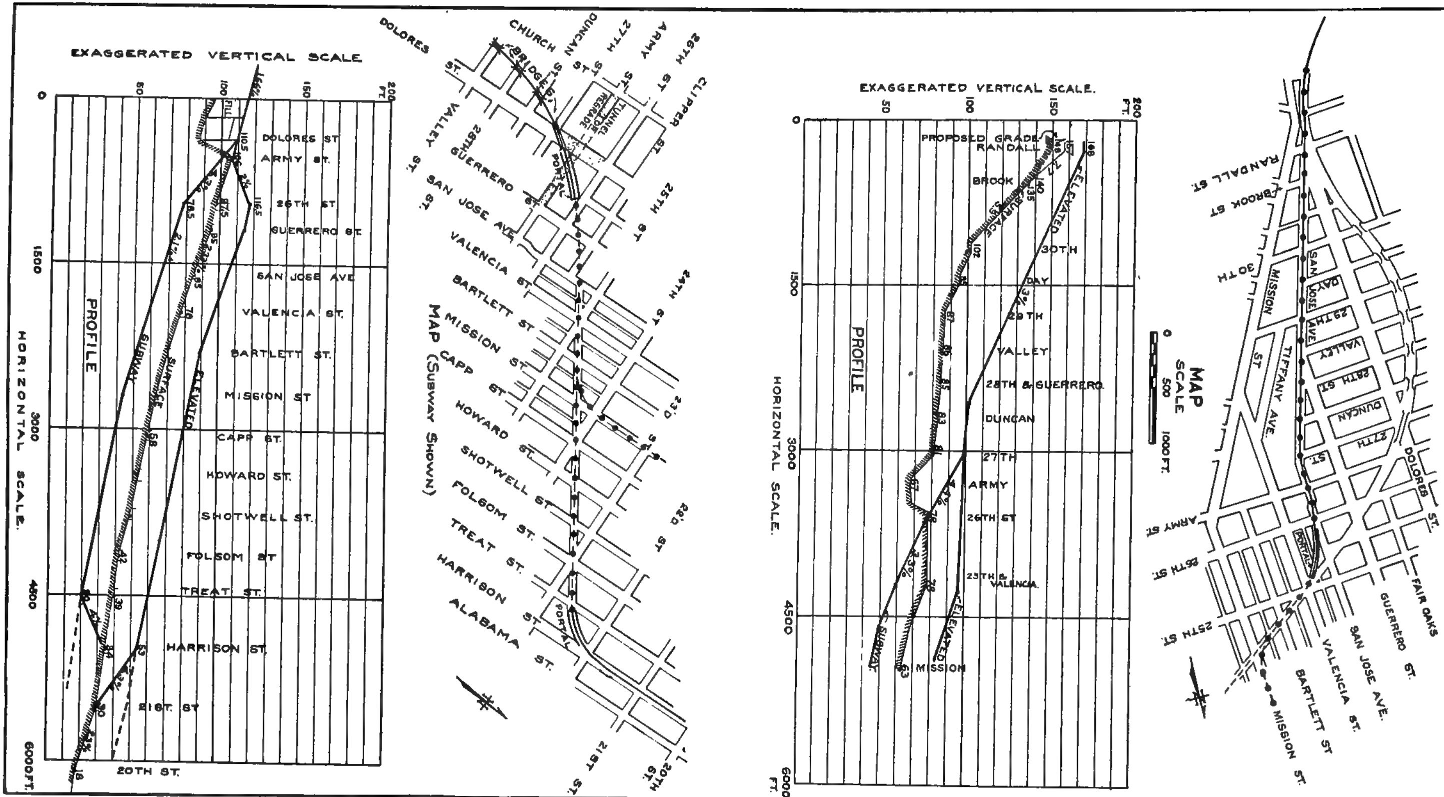


FIGURE 18—BERNAL CUT, MAP AND PROFILE.

This detail shows three alternative methods of utilizing Bernal Cut for rapid transit purposes—(a) by the old Southern Pacific right-of-way; (b) by an elevated connection across the valley in San Jose Avenue, and (c) by future all-subway alignment connecting with a future Mission Street subway branch. The use of the exaggerated vertical scale emphasizes the problem of securing the proper alignment. The dotted line indicates a practicable grade separation at Randall Street.



FIGURES 18*a* and 18*b*—ALTERNATIVE RAPID TRANSIT ALIGNMENTS.

Indicating the possibility of connecting Bernal Cut with both Mission Street subway and Harrison Street surface tracks. The latter may be reached either by subway or by elevated. While the San Jose Avenue alignment involves one relatively unimportant grade crossing at Twenty-sixth Street, the old right-of-way would require a short tunnel or regrade at Army Street to permit of a subway entrance. Either an elevated or a depressed grade crossing through the Mission is regarded as imperative if the old steam road alignment is to be utilized for rapid transit purposes.

of the Southern Pacific Company across existing transit lines of the Mission is essential. Either is practicable, as indicated by the profile studies, Fig. 18 (a), (b). But much depends upon the future of the right-of-way along the Harrison Street and the *re-location* of the present railroad passenger terminal as briefly discussed herein.

A depressed open cut across the Mission would be desirable to provide *direct connection at sub-grade, with a future subway* branch down Mission Street. But unless the Harrison Street right-of-way were then extended northward by open cut to this new terminal, this advantage somewhat disappears. On the other hand, if this suburban entrance were eventually elevated in Harrison and connecting streets as far as the terminal, elevation across the Mission would probably be *most advantageous,* especially in view of the fact that a sub-grade connection with the Mission Street subway at Twenty-fourth Street is not absolutely essential, for a more direct route into the Bernal Cut is available parallel to Mission Street, indicated in Fig. 18. Either a short tunnel or regrading at Army Street will be necessary if a depressed track across the Mission is adopted; but if elevated, no street improvements will be necessary.

Studies of both elevated and subway connection along San Jose Avenue indicate that by the former a more direct connection from Bernal Cut to the future Mission *subway branch* can be accomplished by some regrading in the vicinity of Randall Street, which however will be necessary in any case. A rather high structure in San Jose Avenue would result. And as the use of Mission Street from Twenty-sixth to Randall Streets for either a surface or elevated connection is practically impossible with complex entrance structures, probably the best plan for the present would be to use the Southern Pacific elevated tracks until such time as the more direct all-subway alignment becomes warranted. In this case the Mission Street bore diverts by easy curve to Coleridge Street, crossing Mission Street and reaching Bernal Cut on a tangent at its crest. In spite of this detour, station entrances at Army-Twenty-sixth, at Mission Street crossing, and possibly opposite Twenty-ninth and Valencia Streets, would then suffice for this stretch of Mission Street.

Passenger Terminal. This development naturally leads to a consideration of the proper terminal location for all of this electric train service, and possibly for steam service from the Peninsula. The westerly trend of movement of the retail business center indicates that the Third and Townsend station will become, in the future, *less strategic* as a passenger terminal than now. An entirely new center has been suggested in the Burnham

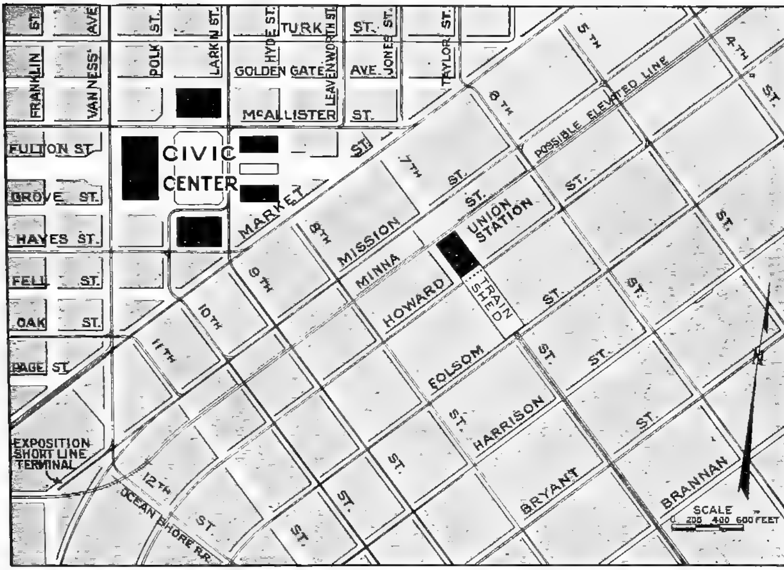


FIGURE 19—POSSIBLE RELOCATION OF UNION STATION

This tentative location for the site of a Union terminal for steam lines, both through and suburban, results from recognition of the fact that the business center is rapidly moving westward. This site is not only nearer the present business center than the Third and Townsend Streets station, but is obviously better located with reference to transit lines and a possible elevated connection with the Twin Peaks tunnel. The advantages of extending Van Ness Avenue to Mission and Twelfth Streets, there connecting with the Ocean Shore Railroad, are obvious.

plan located at the "Hub" of the radial streets in the Mission. With the construction of the Twin Peaks tunnel, an interurban terminal in this vicinity would undoubtedly possess advantages, but for railroad commuter traffic, this site would hardly be available because of (a) the distance from the present business center, and (b) the necessity of an extra fare.

Although it is not a direct function of this report to determine the proper location for a steam railroad terminal, a study of transit needs has pointed unmistakably to certain desirable developments in this regard. These studies indicate that the location of a union passenger terminal, Fig. 19, in Seventh Street between Howard and Mission Streets presents many attractive features as follows: (a) available for *immediate* developments in commuter travel via Southern Pacific *main line*, Southern Pacific Mission branch, Ocean Shore, and possibly a Twin Peaks tunnel elevated entrance; (b) nearer the present business center than the Third and Townsend depot, and within easy walking distance; (c)

will be close to the center of the business district in the not distant future; (d) reasonably convenient to Market Street without causing undue congestion thereon as would be the case if located at the Ferry; (e) accessible by car lines from all directions; (f) well adapted to elevation of tracks leading to the terminal, as a direct extension of the present Seventh Street tracks.

The diagrammatic plan, Fig. 19, points out the relation of these several factors. While the building has been indicated as facing on Howard and Minna Streets, the train shed and interlocking floor may extend further to the south. This location has obvious advantages in the event an elevated road in Minna Street should become unavoidable.

Between Howard and Mission Streets, a 14-ft. rise now exists in Seventh Street. The upper level or passenger floor could then be connected with Mission Street by easy grade ramps and roadways. With Seventh Street extended northerly to McAllister Street, ample thoroughfares would be available for vehicles to the north and west without unduly congesting Market Street traffic. Finally, if such a terminal location were adopted the City's needs would be amply served until later developments necessitated a separate interurban terminal at Valencia and Market Streets in connection with the subways reaching this strategic transit center.

CHAPTER 4

DEVELOPMENT OF PLAN OF PROCEDURE

Franchises, Financing, and Control
Interpretation of Resettlement Franchise

From the foregoing chapters, which have developed the major transit necessities, present and future, of this community, the vital need of some definite plan of immediate action is no doubt apparent. This concluding chapter of the general program, Part I, is therefore devoted to suggesting ways and means of accomplishing the results desired. In addition to matters now lying entirely within the powers of the City, there is outlined a definite common ground upon which City and Company can negotiate a reasonable resettlement. The practical operation of Charter Amendment 34 has also been worked out for the future, and the results are here interpreted in actual values based upon conservative predictions. Should faster growth develop, the results desired will come proportionately sooner. The present financial status of both City and Company are found, by analyses, to practically necessitate some form of indeterminate resettlement. Under the plan recommended, the property is automatically recaptured free of cost to the City within a reasonable term of years. Thus, effective municipal control will be realized without diminution of service or growth.

RECOMMENDED PLAN OF PROCEDURE.

1. The immediate resubmission of Charter Amendment 34 or an equivalent constructed along similar lines. It should be simply an enabling act, including only vital and necessary safeguards for the future, rather than being detailed in matters which should find place only in specific franchises, viz.: wage scale and operating conditions.

2. Resubmission of Public Service Commission Amendment 6, or an equivalent, with provision for automatic expansion of the Commission's activities to ultimately cover all utilities. It should be absolutely free from political dictation and subject to review first by the State Railroad Commission so long as this commission retains its present broad powers, and lastly by the Courts.

3. Resubmission of a charter amendment permitting the City to undertake the acquisition and construction of revenue producing utilities outside of the present debt limit, so that the policy of the City expressed in the present Charter may be fulfilled by gradually bringing street railways under municipal control.

4. A general franchise ordinance should be formulated expressing the policy of the City with respect to both new and resettlement franchises, and embodying the essential elements herein prescribed. While the Commission may properly act in an advisory capacity, determining the necessity for and conditions of franchises, the Board of Supervisors should retain its legislative functions in franchise granting, subject to the will of the people.

5. Preparations for and negotiations with the United Railroads for a possible resettlement franchise, in order that a clearer understanding of Charter Amendment 34 may be had by all parties concerned, and that it may be put into effect immediately after resubmission and ratification.

6. It may become necessary to appraise the property of the United Railroads for the determination of a basis of a fair return on investment, in the event that the Company finds it inexpedient to reach reasonable conclusions with respect to investment that may be recognized with propriety by the City in a possible resettlement.

7. Formulate by resolution or order a plan for the guidance of the United Railroads in the execution of beneficial improvements recommended herein with respect to routing, service and equipment; and determine in connection therewith a definite program of rehabilitation and the accounting methods by which expenditures should be segregated between income and capital accounts.

8. Pending the creation of a Public Service Commission, appoint a small technical staff to continue traffic counts, inspect equipment, analyze operating results, and submit recommendations and reports to the Public Utilities Committee or other designated municipal body regarding the maintenance of proper service and the requirements therefor. The data on traffic and income recorded herein may be used as a basis for reference as to past performance and future needs.

9. Clarify the franchise situation preliminary to a possible resettlement and equalization of terms and conditions by determining upon a policy of clearing the streets of all unused franchises with possible exchanges in minor sections of present franchises or additions thereto which may be necessary to carry out evident improvements in routing indicated herein.

10. Determine the City's policy as to railway extensions and service into Harbor View and to the municipal system in general. At the present time a plan of development of unserved areas rather than of direct competition is recommended. And only in the event of the Company's failure to co-operate in any reasonable plan of improvement would competition be justifiable.

11. It is essential to the welfare of the city as a whole that the advantages of tunnels be more generally appreciated than now, and their construction facilitated with as little delay as possible (particularly before the Exposition in 1915).

12. The City should co-operate with the State Harbor Commission in formulating ways and means for the immediate improvement of the Ferry terminal facilities in order to realize the benefits contemplated from the four-track operating plan on lower Market Street. For the success of the latter close co-operation will also be required between the inspectors of the municipal and private lines operating on Market Street.

13. The City Plan Commission recently provided for by charter amendment should devise ways and means for securing promptly the more important improvements in city plan herein suggested, and at least providing for their eventual fulfillment, even if not now possible.

14. Develop Bernal Cut and Circular Avenue jointly with the Southern Pacific railroad, as a new artery of travel from the Mission for rapid transit, surface railway, and vehicle transportation; this to form an essential requirement of a regrant of franchise for the Valencia branch.

INTERPRETATION OF RESETTLEMENT FRANCHISE PLAN PROVIDED FOR IN AMENDMENT 34

Conditions Confronting City

1. By reason of the pressing water question, the purchasing power of the City is entirely inadequate under the present basis of bonding to cover a possible purchase of the physical property of existing street railways.

2. The City has established the nucleus of a municipal railway system, but has not the bonding power to extend or develop an adequate system throughout the entire city, if such should be deemed desirable or necessary.

3. The City is not receiving a sufficient share in income from railway operations at present to enable it to carry out the exten-

sions which the Company has not carried out. This income now amounts to nearly 5% of which the City gets less than 1% while 4% goes to the State.

Conditions Confronting Company

1. Short-term franchises. In 17 years approximately two-thirds of the mileage will expire, leaving only outlying fragments of lines, with little or no trunk line connection to the business district.

2. Net residual income (above bond interest and sinking fund payments), is only sufficient for dividends on the first preferred, and possibly a small future return on the preferred, but none on the common stock.

3. The future earning capacity of the property *with its required extensions* will probably fall far short of retiring the present unfunded debts at maturities, even assuming no dividends paid on preferred or common stock and no curtailment of the earning power by the action of the City or from other cause.

4. The increasing density of traffic and earnings from the present system should be offset somewhat by the continual demand for improved service, and with the extensions (if made) necessary to realize these estimated earnings, there will probably result little or no future decrease in operating ratio.

5. Less than one-third of the present bonded debt (of U. R. R. 4's) will be amortized by sinking funds, and only about one-sixth of the underlying Market Street Railway 5's at maturity.

6. Although nearly $10,000,000 U. R. R. 4% bonds are reserved in the treasury for refunding underlying securities, these are unavailable for this purpose owing to prevailing low market values. For the same reason, additional stock cannot be sold except at a high interest return, as the deed of trust (U. R. R. 4's) under which the original financing was executed prohibited further stock issues below par.

7. Further refunding by $10,000,000 unissued Market Street Ry. 5's is also impracticable on account of increasing discounts incurred through dilution of present issues, upon which the sinking fund is very limited.

8. The San Francisco Electric Railway's plan of financing extensions through the assistance of benefited property owners is now unavailable on account of Charter provisions. In theory these citizens simply carried the risk of a first mortgage loan

to the Company at par; in practice, they were forced to subscribe the amount of a heavy bond discount.

9. The present Charter practically prohibits extensions from an operating standpoint alone, and does not take into consideration any methods of financing them.

10. Short-term junior mortgage securities might be issued for immediate needs, or further preference stock imposed if approved by the State Railroad Commission. However, both methods would result in high-rate loans and delay still further the earning power of present securities.

Summarizing, it appears that the property can hardly "earn out" by 1929; its sinking fund leaves two-thirds of the present debt unfunded, and until the Charter is amended, money cannot be raised at reasonable rates for extensions to increase its earning power. *But at least one partial remedy exists:*

The bondholders may refinance U. R. R. 4's by 5% bonds, maintaining the same sinking fund, thus scaling down the U. R. R. mortgage debt by 20% or about $5,000,000, and so retiring at maturity a greater proportion of the total debt. This plan would probably increase the market value to at least 85 under present conditions and possibly to par under a fair resettlement ordinance, and provide for refunding underlying maturities on a 5 to 6% basis, while the interest charges and distribution of income would remain unchanged. About $20,000,000 unfunded debt, however, would still remain at the last maturity in 1927.

As an alternative, the stockholders may defer or curtail dividends for a period in order to increase the sinking fund annuities, and thereby raise the market value of U. R. R. 4's to a more reasonable figure for refunding purposes. The stockholders will then eventually derive their return from surplus in the form of residual equities, resulting from debt amortized at maturity.

Results—No Resettlement. The accompanying diagram, Fig. 20 shows graphically the conditions that will probably obtain in 1929 if no resettlement is brought about, if betterments are added only at the minimum possible rate, and with practically no extensions to the property. On the assumption that the Railroad Company would be compelled by the City to cease operation under all franchises which then expire, the earnings would drop abruptly in 1929 to practically their present level; and investment in *operating property* by a corresponding amount due to the expiration of the Market Street Ry. franchise (line not shown on diagram). The present sinking fund requirements will probably retire $13,000,000 out of $40,000,000 now outstanding, leaving $27,000,000 unfunded debt.

However, by refinancing of U. R. R. 4's to 5's, the present (1913) bonded debt would be reduced to about $33,650,000; and with present sinking fund figured upon a 6% basis and carried to maturity this would possibly retire as much as $13,650,000 out of a total of $33,650,000 debt, leaving only $20,000,000 unfunded in 1927 as against $27,000,000 with 4% bonds.* Evidently, in view of the possibilities of condemnation by the City of the fixed property in the streets, neither plan affords the *necessary* security on the unfunded investment, although the proposed refinancing increases this security by one-third.

Resettlement Plans. In order to interpret the provisions of Charter Amendment 34 in concrete terms, a number of profit-sharing plans have been worked out in approximate figures showing the possibilities of the future. These are all based upon an indeterminate franchise of 20 years, with a possible extension to 40 years if the City does not then elect to purchase. All elements of *initial* intangible value in the agreed purchase price are to be decapitalized by a sinking fund within the first franchise period out of the Company's share in earnings, leaving only tangible property to be purchased by the City at its then depreciated value. (These decapitalized values to include depreciation at date of settlement as well as all depreciation which accrues subsequent to the end of the rehabilitation period represented by the difference between the cost of producing the property new and the best condition in which it is practicable to maintain it.) If still operating the property during the next 20 years, the Company is to decapitalize tangible values representing fixed structures in the streets and real estate actually used and useful in operating the road, and in addition, all depreciation which takes place in all new property added after the expiration of the first 20-year period as well as that which takes place after that date on the old property up to the date of purchase by the City. This total depreciation will be the difference between the cost of the property new and the best condition in which it is practicable to maintain it, all of which will amount to practically half of the investment. Ordinary operating upkeep of the property consisting of minor repairs is to be treated as maintenance and all shrinkage in values through depreciation or inadequacy is to be provided for by a renewal fund, both maintenance and renewals to be met out of earnings, so that the property may thus be maintained permanently in good operating condition (75% of cost new or thereabouts).

The accompanying Table 56 shows possible methods of distribution of net income by various profit-sharing plans, ranging

* Assuming the continued purchase and holding of U. R. R. 4's at market price, yielding 6% equivalent return. Out of this $13,650,000, about $1,550,000 must be discharged out of earnings.

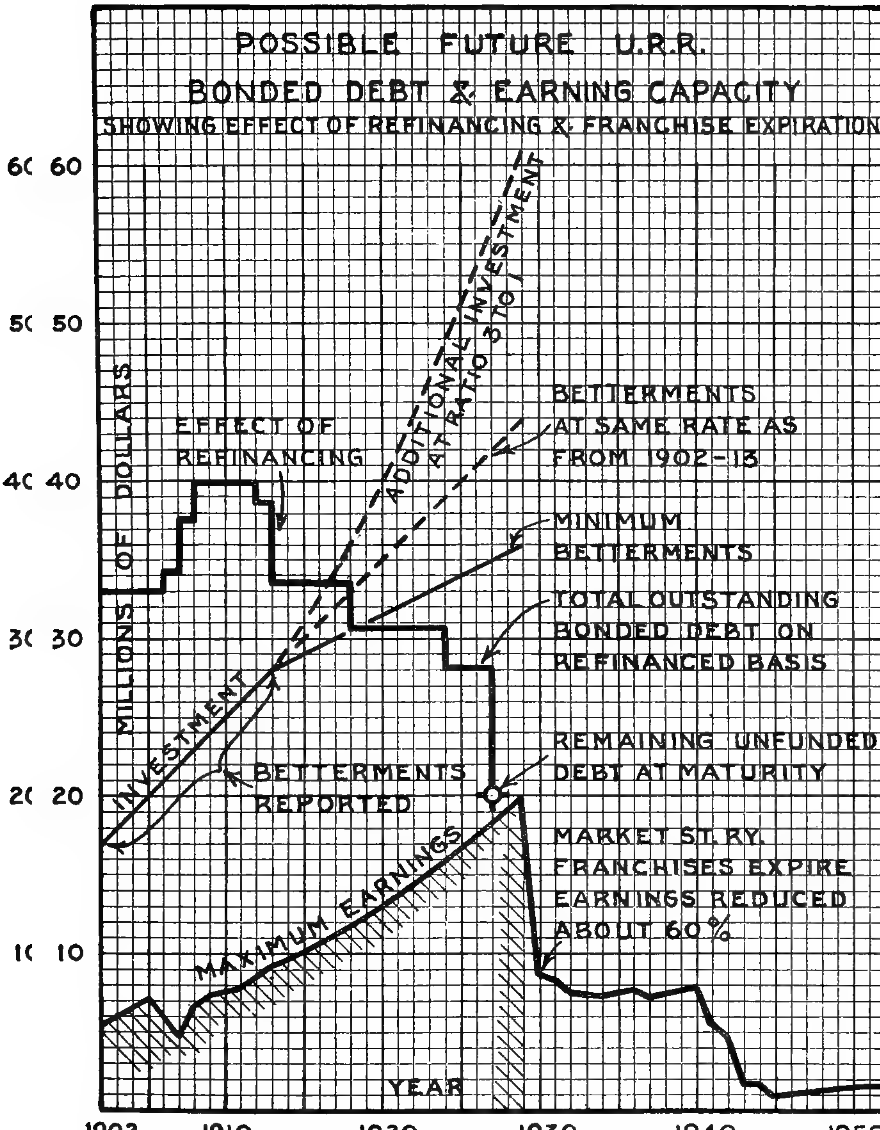


FIGURE 20—FUTURE DEBT AND EARNING CAPACITY.

Curves indicating the probable effect of franchise expirations after 1929, when about 60% of the earning capacity expires; also the total amount of funded debt at various periods and the immediate effect of refinancing U. R. R. 4's to 5% bonds, by which the total debt may be reduced by $5,000,000. About $20,000,000 debt will still remain unfunded in 1929. The curve of minimum investment assumes just sufficient betterments to maintain the operating integrity of the property while the maximum investment curve is based upon a normal investment ratio of $3.00 for each $1 increase in annual earnings.

from the practical "Chicago plan" to those approaching more or less the ideal. In Plan 1 the residual net income is prorated in strict accordance with the present actual distribution of income between Service, Labor, Company and City, shown in Fig. 21. All plans presuppose an *agreed capital valuation* of the property with a 5% return thereon practically guaranteed to the Company as a prior claim on net income; the *residual net income* in excess of this return to be distributed between the various participants in the profit-sharing plan proposed. For the purposes of this analysis, the operating expenses including maintenance, renewals and sinking fund for decapitalizing depreciation, are fixed at 62% of the gross receipts excluding, or 67% including taxes and licenses, with 3% of the gross receipts reserved for amortization during the first 20 years (based upon the smaller initial intangible value or 4% upon the larger) and 3% during the succeeding 20 years. This

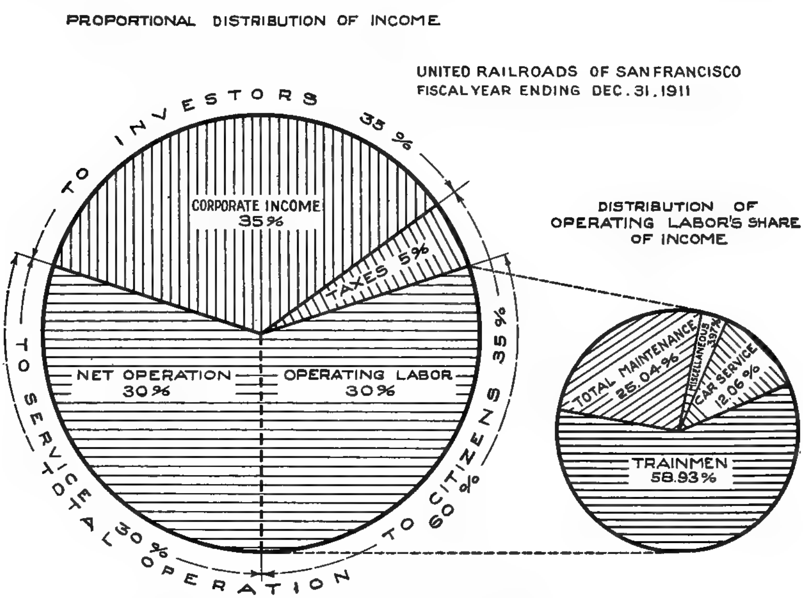


FIGURE 21.—PROPORTIONATE DISTRIBUTION OF INCOME.

What proportion of the total street railway income is received by Company, Public, Labor and Service respectively, is illustrated in this diagram by the relative areas of the "slices." "Operating labor" here includes all employees receiving a wage of $1,500 per annum or under. This labor then comprises just one-half of the direct operating expense and is distributed between the various operating departments in detail, trainmen receiving 59% of the total wages. For every $100 of income, $35 is applied by the Company to the payment of fixed charges, sinking fund, and dividends; $30 is required for service; and $30 pays operating labor, of which platform men receive $18, approximately. Only $5 goes to the Public in the form of taxes; and of this only $1 reaches the City directly.

leaves 30% and 29% respectively available from the annual income for fixed charges, contingency fund, and profit during the first period and 30% for the second period from which after deducting 5% interest on the agreed capital invested in the property, there remains what is herein termed *residual net income.*

Plan 1 assumes the 1911 distribution of the Company's income, Fig. 21, as a basis of participation in the residual net income, which results in profit-sharing between Labor, Company, City and Service. Operating Labor, including the wages of every employee receiving $1,500 per annum or under, gets 30%; the Company 35%; the City 5% and Service 30%. In the share for Service all elements of the operating expenses, *except operating labor* as above defined, may be regarded as *service rendered* to the Public As the business becomes more profitable, a bonus share would thus be available for increased service. This, however, might lead to excess service which would not be warranted under existing powers of regulation in view of the more pressing demands for extensions and decapitalization. Or it might encourage the Company to curtail operating expenses in order to force expenditures from this share for this purpose.

Plan 2, however, "pools" the shares accruing to the City and to Service respectively, in order to give the City the option of either increased service, decapitalization, extensions, or other purposes. The shares to Labor and the Company remain the same as in Plan 1.

Plans 3 and 4 gradually modify the respective shares to Labor, City and Company in a direction affording the City greater purchasing power. However, Plans 1, 2, 3 and 4 provide a bonus for Labor out of *residual net income,* instead of this bonus being charged to operation where labor expenses properly belong. Under present conditions these plans would result in an unwarrantable diversion of revenue from extensions and decapitalization more urgently needed.

Plan 5, which I recommend, includes only the City and Company as direct participants in residual profits, the former receiving 55% and the latter 45%. But provision is also made for Labor sharing indirectly and probably more remuneratively than in Plans 3 and 4 by fixing the per cent of income accruing to all operating Labor—in this case 30%—the difference between this fixed per cent and actual wages paid, to be distributed in the form of a benefit fund insuring employees against disabilities, and also in the form of a bonus and merit system, as discussed in Chapter 17. The advantage to be derived results from increasing car speeds, more efficient routing, and earnings increasing faster than expenses of car operation. This incorporates in the present

"Chicago plan" the bonus principle, which has been put into effect with success in Philadelphia, and, it is believed, secures for Labor a valuable form of insurance which, taken in connection with the relatively high wages paid in San Francisco, should be regarded as an ample share under present conditions.*

Plan 6 does not involve profit-sharing, but rather a distribution of income *arbitrarily fixed* for the remaining franchise period, (presumably subject to mutually agreed adjustment from time to time). Under the distribution assumed the City receives 8% of the total income, Labor 30%, Service (as defined in Plan 1) 32%, and the Company 30% out of which it must provide fixed charges, the amortization and contingency reserve funds and profits. While possibly practicable, it is much less flexible than the previous ones, and does not guarantee the Company any return upon its investment, however small.

Ultimate Financial Results. In the accompanying exhibits, Figs. 22a, b and c, the operations of these various plans are worked out graphically so as to show:

1. Capital investment in property.
2. Purchase price to City.
3. Date of recapture of property.

Values. The initial capital values considered herein were arrived at by judgment *for purposes of illustration* only, and should not be interpreted as an attempt to place a value upon the property. On the assumption that the depreciated or present value of the physical property is about $21,000,000 and that about $7,000,000 should be expended, within the next few years, to bring it up to its assumed "cost to reproduce new value" of $28,000,000, the diagram shown in Fig. 22a has been prepared. After refinancing U. R. R. 4's to 5's the resulting present bonded debt would be $33,650,000. Under Charter Amendment No. 34 all sinking fund accruals must be deducted from the purchase price, thus arriving at a total of $28,000,000 as an assumed value, not including any intangible value except *depreciation.*

That portion of the "intangible value"† of the property represented by franchise value is the earning power of unexpired fran-

*In Philadelphia the fixing of *trainmen's share alone at 22%* of the gross receipts or the same as the trainmen received for the year immediately preceding the date of its adoption, has resulted not only in benefit reserve but also increased wages.

†Such intangible values other than franchise values, are known as development expenses, and usually consist of preliminary technical expense, legal expenses during formation of the company not connected with construction expense, cost of consolidation and reorganizations, sometimes a reasonable promoter's profit, supersession of equipment due to the rapid advance of the art, reconstruction due to unforeseen contingencies, brokerage, discount or premiums on securities, and losses during early operation. All of these and franchise value, if any, should eventually be amortized and eliminated from that value of the property upon which the public should be finally expected to pay a reasonable rate of return, although it is fair that the company should have time to earn and pay to itself this amortization fund out of the earnings of the railway.

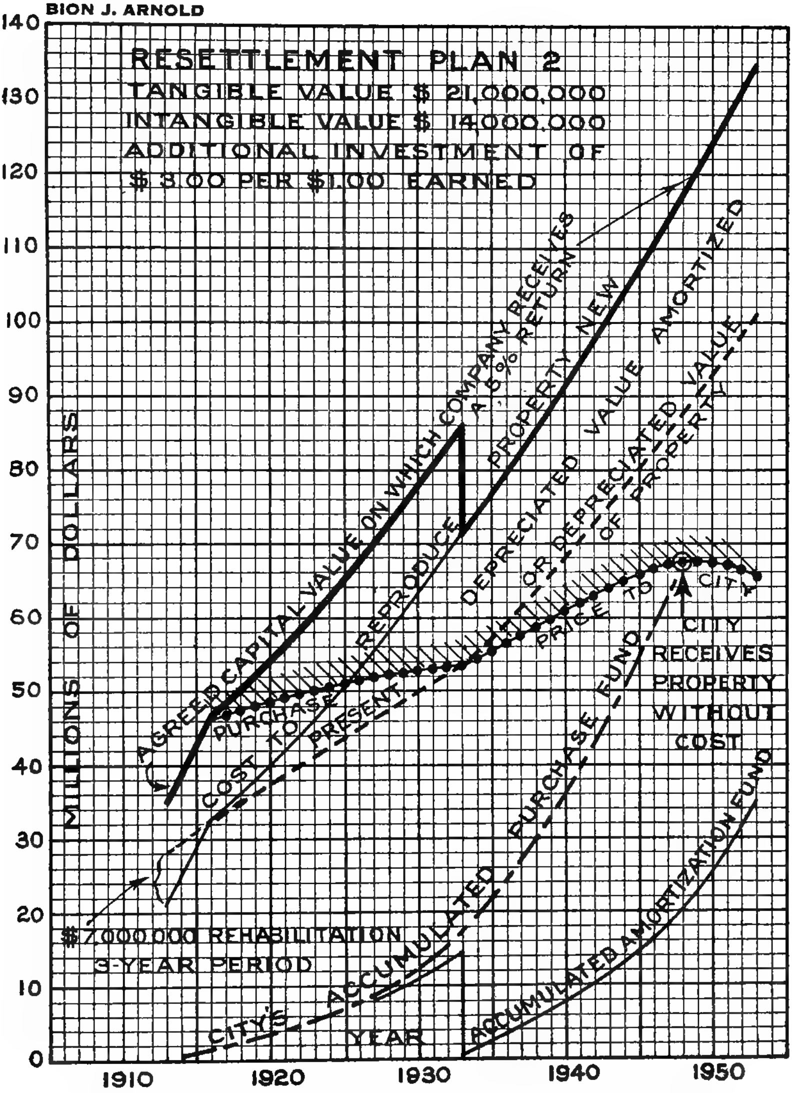


FIGURE 22*a*—PROFIT-SHARING RESETTLEMENT PLAN 2.

Based upon a definite apportionment of net income—35% to City, 30% to Labor, and to Company 35% in addition to 5% prior return on "agreed capital value" (shown by full line). Assumptions: date of settlement, December 31, 1913; depreciated value of property, $21,000,000; initial intangible value, $14,000,000 all to be amortized at the end of 20 years, including $7,000,000 rehabilitation work which is to be capitalized and completed in three years; future investment to increase $3 for each additional $1 earned. The purchase price *to the City* at any date is shown by the dotted line and intangible values to be amortized are indicated by the distance (shaded) between "purchase price" and investment (full black) curves, which values include depreciation accrued both prior to the resettlement and after the completion of rehabilitation. The City's share if allowed to accumulate at 5% should suffice to equal the purchase price by 1947, and thus automatically recapture the entire property to the City without cost by acquiring the underlying securities covering these depreciated values, *i. e.*, the actual value of physical property producing the service

chises, and is usually understood to be the summation of all residual net income from the operating property accruing to the Company from year to year with interest compounded to expiration. But from this gross value would have to be deducted eventually all unfunded debt remaining at maturity not covered by salvage value, thus giving an amount, the "present value" of which would represent the "franchise value" portion of the "capital value" as of today, which franchise value would be more or less affected by the right of the State to regulate rates. Conservative estimates based upon —1st, a minimum and 2d, a maximum rate of probable residual net earnings indicate that this intangible value might lie between $7,000,000 and $12,000,000. However, if unimpaired *earning power and normal expansion* of the system are assumed, these values might lie between $14,000,000 and $20,000,000. While this condition particularly applies to a resettlement plan, which would be most favorable for the City's recapture of the property, it would in all probability be too optimistic for the case in which no such resettlement could be effected, and the Company decided to continue the operation of the present system unextended, with the minimum possible expenditures for maintenance, betterments and service. In this case, the Company would strive to the utmost to "earn out" even with less total annual income, leaving only a run-down property with little salvage for the City to condemn at the expiration of the franchise. Obviously this situation would be aggravated by the extension of the Municipal system.

Financial Plan No. 2. Referring to Fig. 22a, this study assumes a total initial capital value of $35,000,000, with investment increasing in the ratio of $3 to $1 of earnings, until 1933 (20 years from date of resettlement). At this time the intangible becomes automatically retired under the terms of Amendment 34 by sinking fund. Thereafter the purchase price to the City increases much slower than the total investment, and actually decreases after the maximum in 1944. For the entire franchise term of 40 years the investment will be decapitalized from $135,000,000 total to $65,000,000, or over one-half. Through the operation of a purchase fund accumulated at 5% interest from the City's share in residual net earnings, the entire property reverts to the City in 1947. During the later years this fund builds up very rapidly.

Financial Plan No. 5—Recommended. In this modified "Chicago plan," which in my judgment is the most practical of those here presented, the operation of the sinking fund retires all initial intangible value by 1933 as required, but the cumulative City's share suffices to acquire the property as early as 1941 that is, nearly six years prior to the date of recapture under Plan 2.

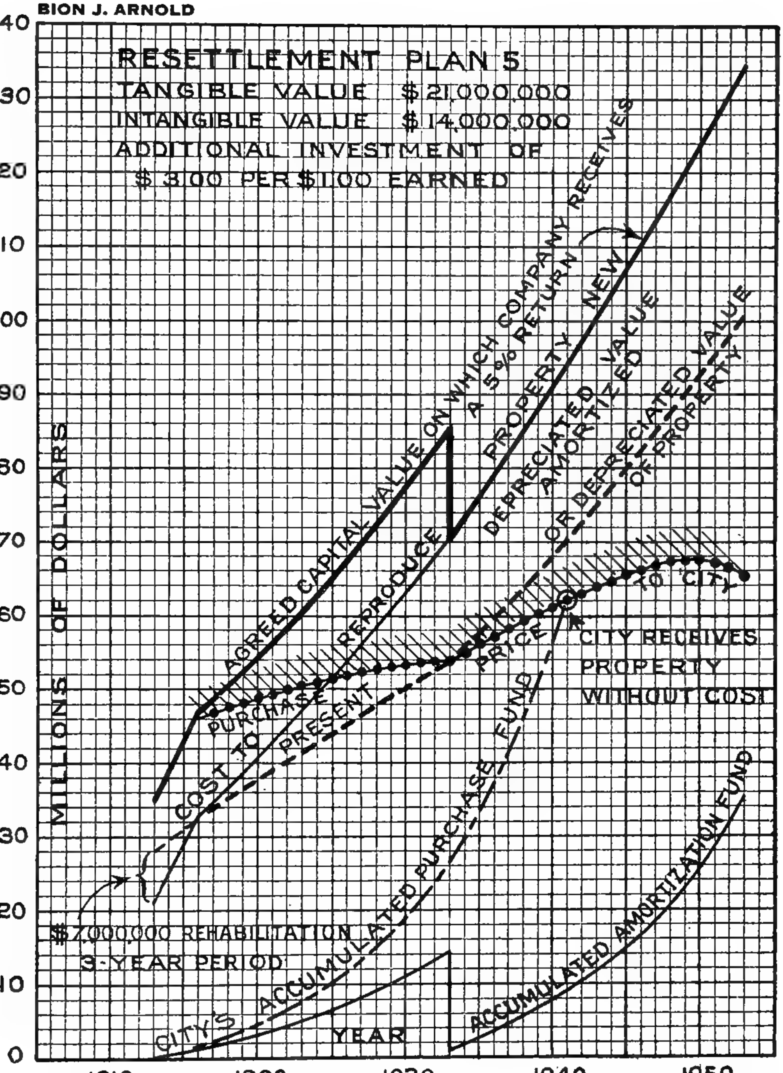


FIGURE 22b—PROFIT-SHARING RESETTLEMENT PLAN 5.

This plan differs from that shown in Figure 22a in that profit-sharing in the residual net income exists *only* between City and Company, the former receiving 55% and the latter 45%. This increase in the City's share over that of Plan 2 enables the City, if it allows its share to accumulate at 5% interest, to take over the property without cost by 1941, six years earlier than in Plan 2. In both cases, an annual reserve of 3% of gross receipts (at 5% interest) will suffice to amortize all initial intangible values allowed (except depreciation). After the first 20 years initial intangible value is retired and this fund starts anew for amortizing part of the physical value. A further fund is necessary for amortizing depreciation (except expenditures for rehabilitation) requiring 4% of the gross receipts for 20 years and thereafter a sufficient amount to cover permanent shrinkage in value through depreciation.

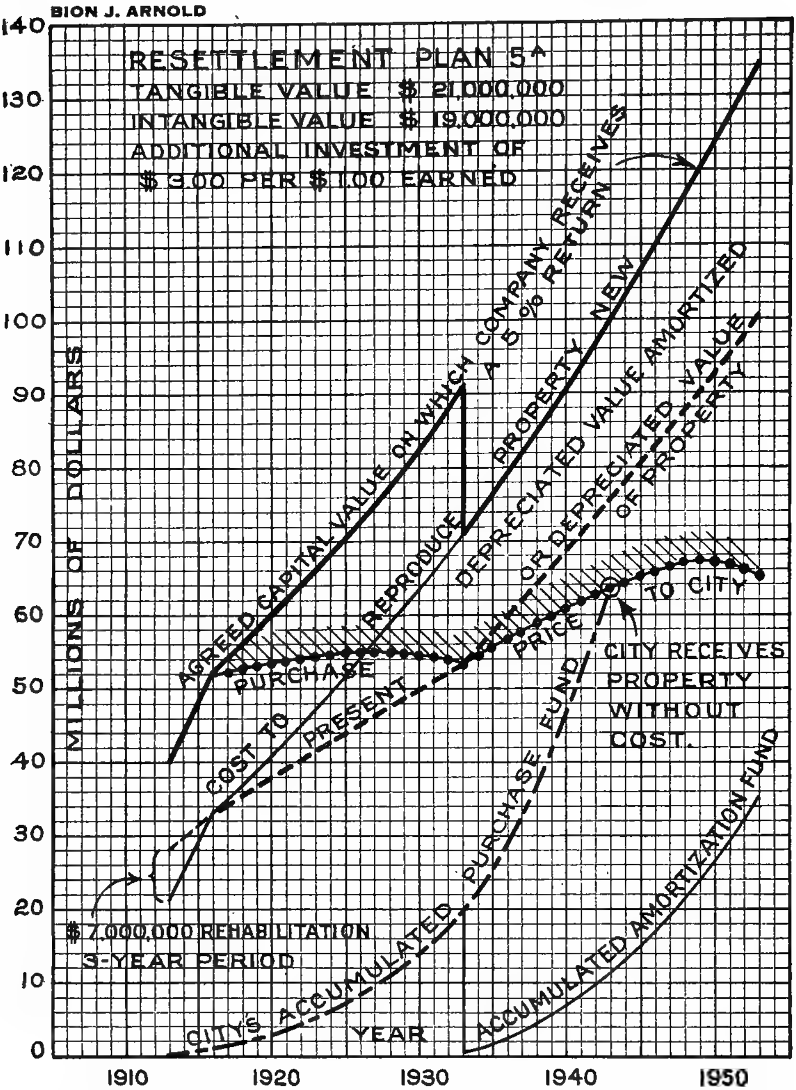


FIGURE 22c—MODIFIED RESETTLEMENT PLAN 5 A.

Profit-sharing in the residual net income between City and Company the same as in Plan 5, Figure 22*b*. The initial intangible value is increased from $14,000,000 to $19,000,000, which requires an amortizing annuity of 4% of the gross receipts for the first 20 years in order to decapitalize this value by 1933. Due to this increased intangible value, the agreed "capital value" is also increased and the residual net income decreased, so that the property reverts to the City two years later than in Plan 5, or in 1943, but four years earlier than in Plan 2. In all these plans the property is assumed to be maintained 75% good throughout the second 20-year period,—*i. e.*, with not more than 25% permanent depreciation.

Assuming in Fig. 22c the higher initial "capital value"—$40,000,000—a larger amortization fund becomes necessary to enable the Company to retire the greater intangible value as required. Moreover, the purchase date will be deferred until 1943—about two years. It will be noted that in all cases, both the amortization and purchase funds increase so rapidly during the later years that the actual amount of initial intangible value has relatively little effect on the date of recapture; whereas within the next few years following the adoption of such a plan, it would be of greatest importance in case the City desired to acquire the entire property.

These studies assume no necessity for progressively retiring capital represented by intangible value within the first 20-year franchise period—that is, that all bonds purchased for the sinking fund are held to maturity. If the serial plan of retirement is adopted, this will simply result in a higher sinking fund and a later date of ultimate recapture. In any such resettlement plan, the City may obtain the greatest advantage by utilizing its full share in a cumulative fund for recapture. On the other hand, if the City applied its share to the building of extensions without further bond issue, it would realize only a partial return on this non-interest bearing investment in these extensions as compared to a full return on these same extensions, if financed by the City through the purchase of the Company's bonds.

If an investment ratio of $3.50 to $1 additional earned were established for future investment in the property, this would result in deferring the date of recapture shown in Fig. 22b by about four years—*i. e.*, to 1945; and in Fig. 22c by about five years, or 1948.

Return on Investment. The estimated returns, Table 57, indicate that the extended property would be able to earn a rate of return on the probable tangible value approximating 10% in 1930, or 8% on the agreed "capital value"; that the Company would receive a return of over 7% on tangible value, and that the City would derive in cash return, exclusive of taxes, as high as 2.0% on tangible value.

Conclusions. In the foregoing, I have attempted to show that only through a resettlement will the City be able, in all probability, to extricate itself from the embarrassment of inadequate purchasing power which limits its ability to expand its traction system and the Company from the curtailment of its earnings due to expiring franchises. By means of this indeterminate, profit-sharing franchise, the three great essentials will be secured:

1. Continuous, adequate equipment and service.
2. Extensions as required.
3. Ultimate municipal ownership.

I see no danger to the City of San Francisco in such a co-operative measure if carried out through a proper administrative body; and I believe that such a measure would represent the greatest step that has yet been taken in the solution of municipal transportation problems. I therefore most urgently recommend the re-submission of the necessary charter amendment and the negotiation of a resettlement franchise.

And finally, I desire to state that the longer the citizens of San Francisco delay meeting this situation squarely, with sound business judgment, the more crucial will become the chaos into which the City is drifting in its utility affairs. The ten years' traction war in Chicago and its solution in the form of the resettlement ordinances of 1907 is a striking example for every municipality confronted with these municipal problems.

PART II

SERVICE AND ROUTING

CHAPTER 5

TRAFFIC AND SERVICE IN THE LOADING DISTRICT †

Results of Traffic Counts
Analysis of Rush Hour Service

In order to determine with any degree of accuracy the conditions of rush hour traffic, it was necessary to conduct a series of detailed traffic counts covering a typical or composite period. The results as applied to the downtown or loading district only are included in this chapter, which has a two-fold object: (1) to show the magnitude of the problem of transporting during one hour over 20% of the total daily passenger traffic; and (2) to indicate what character of service is being rendered on the various railway lines, as shown by a composite "cordon count" in which all outbound passengers were intercepted on their journey homeward from the business district. The detailed application of these results to individual routes is treated in Chapter 7 under the head of "Service Redistribution," wherein proper standards of service are developed. The limits of "downtown" or loading district, may be defined, from a traffic standpoint, as including the points of maximum outbound loading on the individual routes; that is, the limits within which the loading of cars is completed. This subdivision of the traffic problem into business district and out-lying district is an entirely logical one, as the needs of the former differ materially from those of the latter. Owing to the variation in travel from day to day, this traffic study cannot represent all conditions that occur, but rather is intended to give an impression of typical operating conditions existing during a normal business day, that is, excluding Saturdays and Sundays and other days of unusually light or heavy travel.

CONCLUSIONS AND RECOMMENDATIONS

1. Adequate city transportation is largely a question of meeting on the one hand the capacity demands of the four rush hours, when one-half of the total day's travel must be handled, and, on the other, of providing a reasonably frequent headway during the remaining hours of light travel. The former requires, for four hours only, about twice the number of cars and crews necessary for the balance of the business day.

Footnote: These observations all apply to service conditions of July, 1912, and therefore are now subject to some modification due to increase of traffic since then.
†Formerly Preliminary Report No. 11, submitted Dec. 23, 1912.

2. Outside of the extra investment in rush hour equipment, the greatest problem is to provide a reasonable day's work for rush hour trainmen without running idle cars during the day to fill out the working day of "tripper" men.

3. Of the two rush hour periods, the evening has by far the heavier travel—easily 100% greater than the average for the business day, and 20% greater than the morning peak. On practically all lines, maximum travel occurs within a short period from 5:15 to 5:30 p. m., and is approximately 10% higher than the hourly average.

4. A composite passenger count of all lines leaving the *business district* during the evening rush hour indicated a total homeward travel of about 49,000 passengers per hour, 84% of which was city bound, and only 16% trans-bay commuters. Although nearly 15,000 commuters crossed at this time each day, Ferry-bound riding was found to be generally light, as over half of the commuters, encouraged by street and terminal obstructions, walked to the Ferry.

5. Over 42% of the total traffic was carried by Market and Mission Streets, while the remaining streets of the Mission were comparatively little used, thus indicating the desirability of rerouting. All Market Street lines carried only about 11,700 passengers per hour, which gives an indication of the capacity of such a throat of travel. Powell Street, although using the smallest cable cars of the system, was the heaviest loaded cable line, and only carried about 1,500 passengers per hour.

6. The operations of the Traffic Squad have been effective and should be encouraged, as street congestion is responsible for a considerable reduction in speed and carrying capacity. The average operating speed in the terminal district is exceedingly low, but since 1905 the average schedule speed for the city has increased from 7.6 to 8.5 miles per hour, or over 12 per cent.

7. A study of car distribution indicates an excessive number of cars on lower Market Street, due to the progressive delays extending to and in the Ferry loops. This can be relieved by rerouting and terminal improvements.

8. The prepayment principle for collecting fares has not been given a fair trial in San Francisco, especially as applied to short platform cars designed for non-prepay collection, particularly those fitted with fare boxes, which require about two-thirds more time to load a passenger than for the long platform of the latest Oakland cars. With a properly designed platform, passengers can load at a speed of about one second each.

9. A comparison of official schedules of 1909 and 1912 indicates on the whole a small increase in equipment operated as determined by trips scheduled. Checks against operating schedules covering *every car in the system* showed that practically all of the available rolling stock is being operated, there being only 8% idle cars out of the total, 5% being held for emergencies and the remainder undergoing repair.

10. The most direct measure of service is the average loading of equipment during a period long enough to secure *typical* results. This may be expressed as total passenger load in per cent of seats furnished, or as per cent excess loading over seats.

11. Comfortable standing should be limited to 50% above seating capacity for cross seats, 100% above for longitudinal seats, or 3 sq. ft. per standing passenger allowed for normal maximum capacity. Thus, the "California" type prepay car, with a reasonable proportion of cross seats, should not carry much over 90 to 100 passengers maximum at one time.

12. Analysis of service standards indicates excessive loading on many routes. While the average car loading throughout the city during the rush hour was 58% in excess of seats furnished, that of Mission Street was 112% for the hour and for the heaviest 15-minute period both Market and Mission throats showed 135% excess loading over seats furnished.

13. Individual car loading was frequently so excessive as to make it impossible for conductors to reach passengers on non-prepay cars. In one case 90 passengers were missed on a single trip—38% of the registration—which shows the necessity for prepayment platforms, properly designed.

14. The most prolific cause of excessive car loading is irregularity of headway, due to street obstructions, careless dispatching, or improper schedules. At present, delays of three to four times the headway are common.

15. Of all lines throughout the city, those operating on Mission Street are heaviest loaded, and require first attention in decreased headway and better equipment. Of the several cable lines, Powell Street conveys the most passengers during the rush hours, and with the most inadequate equipment.

16. The great interchange of transfer passengers clearly indicates the effectiveness and need of cross-town lines in city service.

17. The new equipment now under construction will probably reduce the average excess rush hour loading from 58% now

to about 38%, which would barely have sufficed for July, 1912 (neglecting the needs of the Exposition in 1915), unless by means of a general rerouting, much car mileage now unused could have been conserved where most needed, thus giving more service for the same number of equipments and trainmen on duty.

18. In conclusion, permanent relief from the conditions above enumerated may be obtained only by, 1st, an increase in car mileage (carrying capacity) to be secured through effective rerouting and additional equipment; 2nd, more uniformity in headway to be secured by improved schedules, inspection and dispatching, and decreased street obstruction; and 3rd, increased operating speed, both in the loading of passengers and along thoroughfares.

GENERAL DISCUSSION

The Problem of the Rush Hour. The wide fluctuation in capacity demand during various hours of the day is due principally to the fact that the requirements of business cause practically all the business population of the city to be moved to and from their homes at about the same periods of the day—that is, from 7 to 9 a.m. and 4 to 6 p.m. During these four rush hours, approximately one-half of the total day's travel must be handled. The accompanying diagram (Fig. 23) indicates graphically the enormous fluctuation in travel that must be met by a properly operated railway system.

Furthermore, a considerable difference exists between morning and evening travel in the suddenness and severity of the peak loads. Owing to the lesser rigidity of business hours in the morning, travel is spread over a longer period than in the evening, resulting in a lower peak load. Thus, the *outbound* evening peak is 2.4 times that of the morning; while the morning *inbound* peak is only 1.4 times as great as the inbound evening peak. And finally, the difference in this fixed riding habit is shown in a total evening peak, both inbound and outbound, 1.2 times or 20% more than the morning peak. It is thus clear that any condition tending to restrict business hours within definite limits tends to accentuate the suddenness and severity of the daily rush hour peak load, and the difficulty of giving adequate service.

Analyzing the evening rush hour travel in more detail, it is found that the maximum on practically all lines occurs in this city between the hours of 5 and 6 p.m., outbound. This is shown in Fig. 24 where the maximum crest for the entire system occurs within the second 15-minute period. As these counts were taken at the

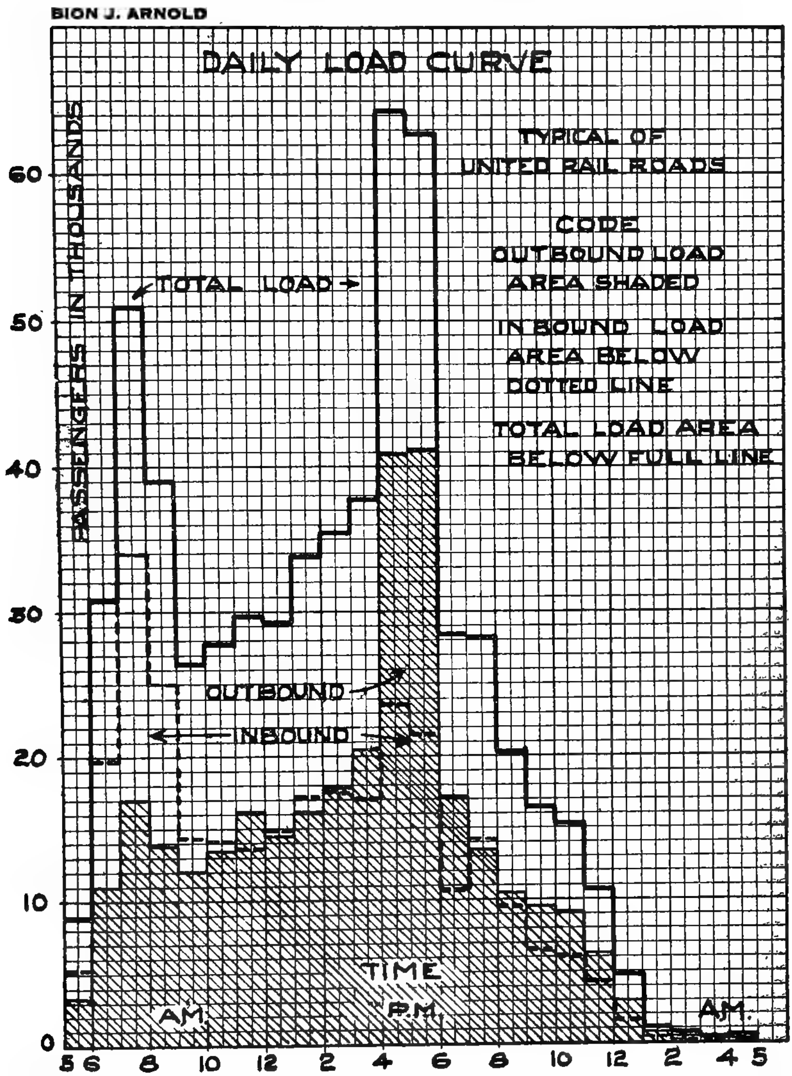


FIGURE 23.—TYPICAL DAILY TRAFFIC LOAD CURVE.

Showing outbound, inbound, and total passenger travel for the United Railroads system for each hour of the day. The fluctuations within the hour are not indicated in this diagram. The shaded section indicates outbound travel which gives the most severe daily peak. Note that the morning peak, inbound (dotted lines) is considerably less severe than the evening outbound peak, which simply increases the difficulty in arranging schedules convenient for extra or tripper trainmen. For the evening rush hour practically double the equipment is necessary as for average day service.

point of *maximum loading* on the individual routes, the maximum period—5:15 to 5:30—simply reflects the result of the closing of the official day at 5:00 p.m. Market Street alone shows the peculiarity of a peak later than 5:30, due to the closing of the retail stores generally at 5:30. However, the total variation within the hour is only 2,400 out of 12,200 passengers, or less than 20% of the total.

The problem of the rush hour therefore constitutes the *major* problem of street railway transportation, on account of the burden it imposes in the matter of extra equipment and accessories, and particularly extra platform expense (motormen and conductors) for short-time men, who are forced to accept a four-hour working day or thereabouts, unless the midday schedule is *deliberately increased* for the sole purpose of giving these short-time men reasonable employment. This conclusion, then, is capable of two interpretations:

First. With an adequate day service, the rush hour service must be exceedingly poor.

Second. With an adequate rush hour service, the day service must be unnecessarily good.

This condition, in effect, has occurred in the street car operations of this city. While the maximum evening travel is 2.4 times the minimum midday travel, the *maximum car movement* is only 1.65 times that of the minimum midday—that is, 65% additional trips are run during the evening rush period, which is far too low for a proper balance of service. In most large American cities practically double service during evening rush hour is found necessary. This rush hour *service ratio* must be interpreted with caution, however, and in the last analysis, *the only absolute criterion is actual average loading of equipment.* This has been determined by the composite day counts, as later presented. Even this measure of the possibilities of service may be misapplied, for it is possible by a too rigid application of the unit capacity rule to prescribe a rush hour service that cannot be sustained by the resultant net earnings from the business.

Seasonal Variation. In this connection, it should be recalled that the seasonal variation in traffic in the City of San Francisco is relatively small,* as the riding is nearly as heavy in summer as in winter, so that practically the same rolling stock may be used throughout the year. In some cities, where the seasonal and climatic variation is many times greater, an entirely separate equipment of summer cars becomes necessary, the duplicate investment in which lies idle during the winter months and *vice versa.* This condition

*About 10% above and below mean; Maximum, October, November; Minimum, June, July.

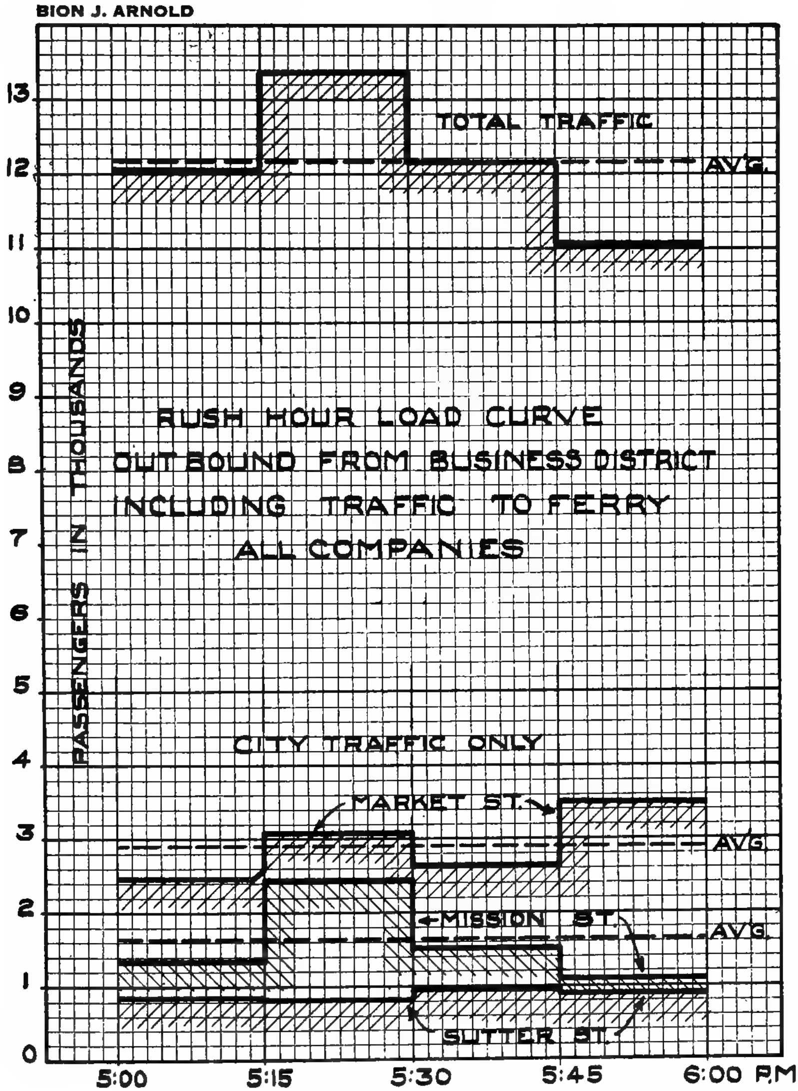


FIGURE 24—TYPICAL RUSH HOUR LOAD CURVE.

Showing the wide variation in travel during the maximum evening rush hour—5 to 6 p. m. This analysis applies both to the total system outbound from the business district, and also to important throats of travel. Note that the maximum period of travel occurs between 5:15 and 5:30 p. m. (excepting on Market Street and a few other lines), with a peak 10% higher than the average for the hour as designated by Fig. 23.

manifestly results greatly to the interest of any company operating in San Francisco in reducing its investment and thereby increasing the possibilities of good service.

Vehicle Traffic Counts. One very serious cause of the increased difficulties of giving adequate service is the interference of vehicle traffic. A very material improvement, however, has resulted from the institution of traffic regulation in this city by the Police Traffic Squad, with the result that heavy and slow moving vehicles are being gradually encouraged to seek and follow less congested thoroughfares, which has greatly facilitated passenger movement.† Table 18 shows the actual volume of traffic which now exists at the various intersections listed. The more effective this regulation, the more will passenger transportation be improved in this city. As an illustration, the vehicle movement at Fourth and Market Streets has already been reduced by traffic regulation over 100% since last year.

Schedule Speed. The average operating speed on typical main thoroughfares has been compiled in Table 19 for the purpose of comparing the so-called "city terminal" district with typical sections of lines in other parts of the city, where slow, medium, and rapid running occur. While the average schedule speed for the entire city is 8.5 miles per hour, the actual operating speed in the terminal district is but little over half—4.4 miles per hour; in the next zone of operation, 6.7; further out in the districts where vehicle interference is small, 8.9; and finally on thoroughfares clear of interference, as high as 11.3 miles per hour.

This exceedingly low speed in the central terminal district, averaging about the same speed as brisk walking, undoubtedly accounts for the loss to the railway company of a very large amount of *short-haul* traffic, which is by far the most lucrative of all the traffic handled. Therefore, *any measures tending to increase running speed will make possible more service in the poorly paying outlying districts for the same total income per year.*

Since the electrification of the cable lines, the schedule speed has increased about 12% and is continually improving, thus realizing one of the greatest advantages of electric service.

1905—7.599	1908—7.91	1911—8.43
1906—7.647	1909—8.113	1912—8.509*
1907—6.85	1910—8.284	*Eight months only.

These average figures are based upon the actual car hours or running time of trainmen.

†Typical conditions of the congested downtown street intersections are illustrated in Chapter 6, Fig. 27.

Effect of too Frequent Stops. Another important element in preventing high schedule speed is too frequent stops. Numerous observations made on various routes indicate a relation between stops and speed as follows:

10 stops per mile, 528 ft., 7.5 miles per hour.
8 stops per mile, 660 ft., 8.4 miles per hour.
6 stops per mile, 880 ft., 9.4 miles per hour.
4 stops per mile, 1320 ft., 11.0 miles per hour.
2 stops per mile, 2640 ft., 13.7 miles per hour.

Thus a stop at every city block of 400 feet permits a speed of only 6.4 miles per hour, while a stop at every other block would permit an increase in speed of over 40%—to 9.2 miles per hour. This illustrates the necessity of eliminating every stop not actually needed for serving the *majority* of passengers, and also the desirability of alternate stops in sections of the city where very short blocks occur. That 550 ft. is not an unreasonable hardship is apparent from the fact that the standard block in the 100-Vara district is now 633 ft. wide by 908 ft. in length along trunk lines (including streets). In Richmond and Sunset the average block is only 310 ft. wide along trunk lines, making possible over 17 stops per mile—entirely too many for a through or trunk line.

An effort may well be made to improve conditions on all trunk lines in the city, of which the following are typical:

	Stops per Mile.
Market Street, one mile west from Ferry building..	11
Mission Street, one mile west from Ferry building..	9.4
Sutter Street, Market Street west................	11
Third-Kearny, Mission Street north..............	16
Fillmore Street, McAllister Street north..........	16
Ninth-Polk, Post Street north...................	15
Cable lines, from termini........................	12

For one stop per mile saved (within ordinary ranges of speed) an increase of speed averaging about 5.6% will be realized, this percentage increasing in proportion as the speed of the line increases.

Relative Loading Time. The results of a large number of observations on the various types of cars in service indicate that the *prepayment principal has not been given a fair trial in San Francisco,* because of its being applied to cars designed for non-prepay service with short or constricted platforms. Thus, for a group of 25 passengers boarding at one point (a condition which occurs at the Ferry regularly), the short platform cars fitted

with fare boxes require about two-thirds more time per passenger than for the long platforms in the latest Oakland cars fitted with a movable handrailing, and twice that required by the standard Chicago car.

In Chapter 9, detailed recommendations are made for the improvement of the present platforms and entrances in order to facilitate loading speed on existing equipment.

Car Distribution. An effective graphic illustration of conditions in San Francisco resulting in the present congestion of cars along Market Street is the car location map, Plate 6, showing the *actual distribution* of all cars on the system at the time of maximum evening traffic—5:15 p. m. While the rectangular plan of streets south of Market provides outlet thoroughfares for cars from the business district along parallel streets, no such thoroughfares exist north of Market, with the result that all lines of the Western Addition, as well as the cross-town lines of the northern district, must feed directly into Market Street, resulting in the congestion indicated, which is equivalent to an average headway of only 28 seconds between cars.

This condition can only be relieved by the improvement of loading speed, diversion of unnecessary vehicle traffic, and rerouting of cars in the terminal district, plans for which are presented in another chapter.

Comparison of Headway, Past and Present. The actual headways observed on the various routes are of interest here as compared with previous records.

(1) Service count, conducted by the Chamber of Commerce in 1909.

(2) Schedule submitted by operating company to the Board of Supervisors in 1911.

(3) Check count made during the present year *prior* to the composite traffic count, and without the knowledge of the operating company.

These comparative checks show not only a general improvement in service, although small, but also no evidence of attempt by the operating company to temporarily improve the service on particular lines counted while the traffic record was being obtained. Further evidence against possible distortion of the records by the temporary addition of cars is offered by the fact that the entire available equipment had been in regular service, which automatically prevented any further equipment being pressed into service.

Check on Service. Additional check counts were made on July 1st and July 15th without the knowledge of the operating departments for comparing the official operating schedule (Table 24) with the equipment *actually* operated on the streets during these typical working days. At the same time, the equipment reserved in the car houses and shops or storage yards was noted, with the following results, indicating a very slight variation in commissioned equipment:

	July 1st.	July 15th.
Number of trips operated	7,594	7,607
Number of cars commissioned.....	596	607

Practically all of the available rolling stock was operating under the existing week-day schedule—that is, every car was sent out on a rush hour trip, either on a "regular" or an "extra" run. Out of a total of 661 cars, 32 cars were found in the various car houses and 22 in the car shops undergoing repair. Thus with only 8% idle cars, 5% were held ready for emergency service. The operating company is therefore using its available rolling stock to the best possible advantage, and it is a creditable showing that *so large a percentage of its equipment remains in service,* which indicates a high degree of maintenance. This, of course, has no bearing upon the question whether or not this equipment is adequate for the requirements of rush hour service.

Car Capacities. In the development of a "service standard," an element of pure judgment arises in what may be considered as car capacities—that is, seated load plus standing load. Various methods have been applied heretofore to obtain a measure of "comfortable" standing capacity:

First. Standing floor area has been computed at a fixed number of square feet per passenger, considering standing passengers as distributed indiscriminately throughout the car without reference to the maintenance of a proper aisle space.

Second. An arbitrary number of standing passengers is allowed opposite each seat.

I am inclined to favor the second plan, as it is definite and more applicable to the particular type of car under consideration. Thus, as a general rule, for cross seats 50% additional standing capacity will permit of the *maintenance of the proper aisle space*—that is, one standing passenger opposite each two seated; and for longitudinal seats 100%—that is, one standing passenger opposite each seated passenger—both exclusive of platform. The longest platforms of San Francisco cars will accommodate from eight to

ten standing passengers, and the short platforms, five or six. This rule applied to the wide Sutter Street cars on the one hand and the standard Geary Street cars on the other results in a relative "comfortable" capacity of 98 and 81 respectively, both with 44 seats in the car body.

While the above rule may be regarded as a "comfortable capacity" for the modern double-truck San Francisco car, excessive loading under unusual traffic conditions such as baseball games warrants a higher loading. On a basis of three square feet per standing passenger, the wide longitudinal seat car will accommodate 108 passengers, and with two square feet per standing passenger, 134 passengers per car.

It is therefore recommended that reasonable standards to be applied to all types of cars are as follows:

(1) Comfortable standing, 50% in excess of cross seats, and 100% in excess of longitudinal seats, plus platforms.

(2) Normal maximum capacity, three square feet per standing passenger.

(3) Emergency maximum capacity, two square feet per standing passenger.

The appended Capacity Table 20, is based upon these standards, and applied in the rerouting studies later discussed, excepting that they have necessarily been reduced on all prepay types of cars by a sufficient amount—10%—to compensate for non-uniform car loading. On this basis, the carrying capacity of a trunk line operating under a 30-second headway (as in the case of Market Street) will be as follows:

	"California" Type Prepay Car.		Longitudinal Seat Prepay Car.	
	Per Car.	Per Hour.	Per Car.	Per Hour.
Comfortable carrying capacity...	73	8760	86	10320
Normal maximum capacity......	78	9360	98	11760
Emergency maximum capacity..	95	11400	121	14520

Preferential Standing. Allowance must be made, especially in San Francisco, for the existing fact that many passengers stand by preference even when seats are vacant. The proportions to which this preferential standing may extend are well brought out by an investigation by the Wisconsin Railroad Commission covering many thousand observations, and which showed that with a *full carload as high as 20% of the seating capacity represents standing by preference.* This only emphasizes the necessity

of a car design for San Francisco which will recognize the desire of many persons to stand, especially smokers, and consequently *the necessity of providing ample open-air space.* This relation is abstracted from reports of the Wisconsin Railroad Commission. (Harris on the Milwaukee St. Rys.), as follows:

Total Load on 42-Seat Car.	Total Average Passengers Standing by Preference.	Percentage Standing by Preference.
1-4	1	
5-9	1.3	20.
10-14	2	17.75
15-19	3	17.9
20-24	4	18.2
25-29	5	18.5
30-34	6	18.8
35-39	7	19.1
40-42	8	19.5

Passenger Flow—Rush Hour. In the study of travel during the maximum or evening rush hour, it is necessary to consider only that *outbound* from the business district in defining the existing service standards. Although the same number of cars are actually operated inbound, the inbound travel is extremely light and the cars are so operated that they may loop and return to the loading district at the proper time to pick up outbound travel. This simplifies the study considerably and makes it possible to illustrate rush hour conditions by means of such a diagram as shown. Here the traffic is considered as originating in all directions from the *center of the business district,* Third-Kearny-Market Streets, consequently trans-bay traffic bound to the Ferry on so-called "inbound" cars are here considered as outbound travel, but computed separately.

The graphical record, Fig. 25, clearly indicates the preponderance of traffic on Market and Mission Streets, the convergence of Western Addition traffic into the Market Street throat, the relatively large traffic already on Mission Street as compared with parallel thoroughfares, the relatively small carrying capacity of the cable lines; and finally, the small amount of traffic riding to the Ferry as compared with the total known trans-bay traffic, due to the prevalent walking habit of these commuters.

From this diagram, it is clear that the streets of the 100-Vara district, parallel to Market and Mission Streets must be used more for the relief of these most important thoroughfares, for the diversion of traffic to Mission Street would eventually reproduce present Market Street congestion there unless some of the present

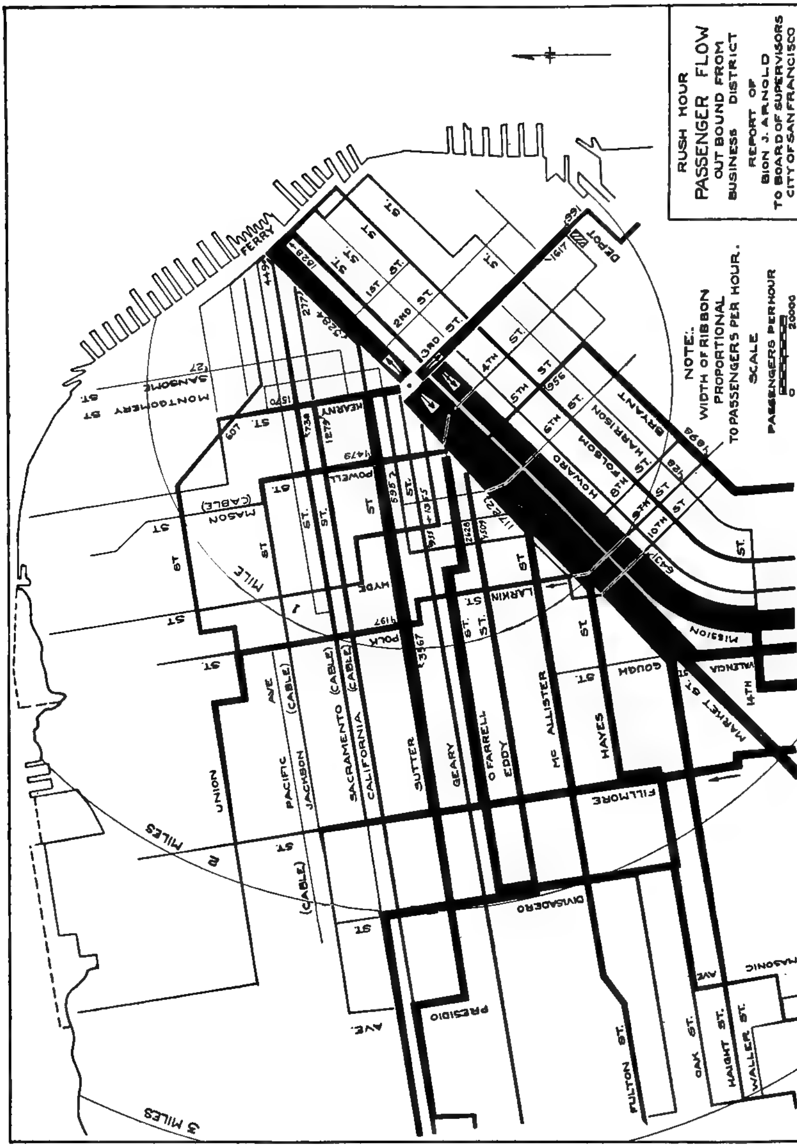


FIGURE 25.—DIAGRAM OF PASSENGER FLOW OUTBOUND FROM BUSINESS DISTRICT DURING EVENING RUSH HOUR.

This record is based upon a composite traffic count of the entire city at throats of heaviest travel. The relative widths of lines indicate graphically the proportionate volume of travel over the various outbound thoroughfares, also the progressive decrease in load toward the outer termini. Numbers indicate actual volume of travel at various throat points. Note the comparatively small usage of thoroughfares south of Mission Street and small volume of travel toward the Ferry. Third and Kearny Streets are considered as the dividing line of travel city-bound and Ferry-bound, respectively.

Mission Street traffic were diverted still further to the south. As Howard Street is the only low-grade parallel artery that may be reserved for heavy vehicle traffic, Folsom Street must ultimately be pressed into further use for traffic to and from the Mission.

Total Rush-Hour Travel. A summary of observations on all these various outbound routes, Table 22, shows that for a typical composite business day, 48,659 *passengers traveled homeward on the surface cars during the maximum rush hour* period—5 to 6 p. m. Of this total, 42,370 or about 87% were handled by the electric lines, and less than 13% by the cable lines; and 40,821 or about 84% represents city-bound traffic, the balance or 16% representing trans-bay commuter traffic to the Ferry terminal. Of the 42,370 passengers traveling on the electric lines, the Market Street lines carry 11,722 per hour, or 27.6%, Mission Street lines 6,435 or 15.1%, and the Sutter Street lines, 3,586 or 8.4%. The heaviest cable line, Powell Street, carries less than 1,500 passengers per hour, which slightly exceeds the travel on Jones-Hyde cable line. Thus the *smallest* cable cars of the system are called upon to handle the *heaviest* rush hour travel, although least adapted for excess loading.

In addition to this street railway travel, the ferries carry the following commuter travel during the maximum evening rush hour:

	Per Hour
Commuter traffic to Oakland, Berkeley and Alameda....	12,480
Marin County	1,730
Total trans-bay	14,210
Deduct city travel to Ferry..........................	7,838
Pedestrian commuters to Ferry	6,372*
Add city-bound travel	40,821
Grand total outbound passengers, exclusive of commuters walking to railroad depot†....................	55,031

Throat or Cordon Counts. Data for the throat or cordon counts comprised in the totals presented above were obtained by stationing observers at the various *points of maximum loading* on each of the outlet throats of travel. (Table 21.) The resulting records, shown for convenience in graphical form, indicate not only the fluctuations in traffic within various periods of the hour

*To check this figure, a count of pedestrians was made by the Traffic Bureau, at Market Street and The Embarcadero, which showed 5,000 persons using the north side, and 2,410 the south side of Market Street between 5 and 6 p.m., or 7,410 persons total through the Market Street throat.

†About 560 persons walk to the depot during rush hour.

(Fig 24) and the relative loading of cars with respect to the seating capacity (Fig. 26), but also the comparative regularity of cars on schedule. (Plate 7.) Thus, for the Market Street throat at McAllister Street, cars passed at an average of 28 seconds headway, with only two or three delays between cars, the maximum, 1′45″ duration.

The wide variation in passengers carried *per car* is in fact a peculiarity of riding habit, rather than due entirely to irregularity of headway. There will be noted in Plate 7 two crests of travel:

First—From five o'clock shoppers and office employees; and
Second—From the closing of business at 5:30 p. m.

Individual loads occasionally appear extreme—in several cases as high as 150 passengers per car of 44 seats seating capacity; and this represents passengers *actually on the car at one time,* rather than the total aggregate fare registration at the end of the trip which might result from multiple riding.

In contrast to this outbound Market Street throat, the outbound traffic to the Ferry is exceedingly light—for the most part *below* seating capacity. Only two peaks occur—shortly after 5 and 5:30 p. m. As previously pointed out, this is due to the walking habit of trans-bay commuters.

The Mission Street throat, observed at Tenth Street, shows a very excessive peak for five o'clock traffic, and great irregularity in headway. This irregularity has been confirmed by other observations of terminal arrivals and departures at the Ferry.

These Mission lines undoubtedly show the heaviest loading of cars of any of the lines of the city, and on such lines as "24th & Hoffman" the equipment is least adapted to care for this excessive loading. With an average headway of 51 seconds, delays were recorded of 3′30″ duration, which resulted in a maximum load as high as 185 passengers for a 44-seat car. This is all the more pronounced in view of the fact that when the Mission Street cars are uniform in headway, the fluctuations in loading due to riding habit are not nearly as sudden as on Market Street.

The Sutter Street throat, counted at Polk Street, showed fair uniformity with maximum loads of about 100 passengers when no delays occurred, or 125 with delays of 3′45″, and with no pronounced 5 o'clock and 5:30 peak. This throat approximated more nearly a proper standard of service than any other lines of the city.

The California Street count shows a remarkable uniformity in riding habit that can only be explained by its having an individual patronage, and it is the best example of the suppression of violent rush hour peaks as the result of uniform headway. The rush hour

loading standard is easily within the limits of comfortable standing, as defined above, although it is to be said that standing continues for the entire length of the line, whereas on the longer electric lines, standing does not continue beyond one-half or two-thirds of the run.

The traffic on Geary Street, just before the replacement of the cable line, indicated in some respects a similar uniformity in patronage throughout the rush hour and with somewhat lighter loading than California Street.

The Powell Street cable line, on the other hand, shows a tendency toward two peaks during the rush hour, as in the case of the electric lines, and with a tendency toward irregularity in headway, which results in exceeding the comfortable standing capacity.

Cross-town lines, such as Polk Street and Fillmore Street, show only one crest of travel during the hour, generally following the five o'clock load.

The general deductions from these records are that the most prolific cause of overloading is *irregularity of headway*. It is unquestionably the fact that during the time these counts were taken considerable delays were encountered on the Mission Street thoroughfare, due to the excessive heavy vehicle traffic that had to be diverted from Howard Street to Mission Street during the installation of the sewer, making Howard Street impassable. But at this time, the Police Traffic Squad started in its work, and the traffic congestion would probably have been worse on both Market and Mission Streets, had it not been for the police regulation, which has given most beneficial results.

To emphasize this point of delays, it is only necessary to consider the effect on waiting patrons of the following observed *departures from uniform headway* on some of the lines during the rush hour:

Line.	Departure.	Headway	% Off
McAllister	3'18"	2'30"	132.0
Haight	3'15"	2'00"	162.5
Valencia	3'15"	2'00"	162.5
Market	3'15"	2'00"	162.5
Ingleside	6'30"	6'00"	108.3
Twenty-fourth and Mission	8'30"	2'30"	340.0
Bryant	2'53"	4'00"	72.0
Kentucky	3'30"	4'00"	87.0
Kearny and Beach	4'15"	4'00"	106.0
Ellis and Ocean	2'00"	2'00"	100.0

Compare the above with California Street cable line and Sutter Street:

Line.	Departure.	Headway	% Off
Sutter	1'00"	2'00"	50.0
California	1'30"	2'30"	60.0

It should be said here that the character of some of the equipment on Mission Street is least suited to the handling of these excessive crests of travel. And the first steps toward the improvement of service should be taken on these lines, rather than on lines such as Sutter Street, where the conditions, relatively speaking, are not nearly as serious.

Load Distribution Along Route. To illustrate the reason for the selection of the points of traffic counts listed in Table 21, it is only necessary to refer to loading curves for typical routes, Fig. 39, which show progressive loading and unloading from terminal to terminal. Here it will be noticed that maximum travel occurs on the various routes at a distance from the origin which has very little bearing upon the location or the length of the route, but rather reflects the peculiarities of the riding habit. On this account, *all throat counts have been checked at points of maximum loading* with reference only to actual trip records.

This diagram, Fig. 39, is designed to show the relative loading at various points of the line with respect to the maximum only, and irrespective of the actual number of persons on the car. It may therefore be called the *route characteristic curve* applicable to all rush hour cars. These records have been obtained for all lines and are interpreted in the "Rerouting" chapter.

Analysis of Service

The relative degree or quality of service is best expressed by ratio between seats furnished and total passengers carried at the maximum loading points. It has already been stated that if this average car loading is analyzed by different periods shorter than one hour, the relative loading appears much higher than the average for the hour. In the accompanying analysis, Table 23, the percentages are obtained for 15 minutes and 30 minutes, as well as for 60-minute periods, since the use of as short a period as 15 minutes is impracticable on lines of very long headway, as average conditions would not result; but this period is not too short for lines of heavy traffic.

Rush Hour. Taking the hourly basis, it was found that the average loading for all lines of *city-bound passengers only* was 158%, *i. e.*, 58% excess passengers over seats; or for every 100 seats outbound there were 58 passengers forced to stand. For the electric lines only, the corresponding loading was 159% and for the cable lines 156% of the seating capacity.

These figures give due credit to the operating company for all unoccupied seats—that is, they recognize the *standing by prefer-*

ence, due to the fact that many people stand even with seats vacant, as has been previously explained. This standing by preference is rarely credited to the companies in the consideration of service standards.

If the transbay traffic to the Ferry be included, the average loading for the system is then reduced to 131%, due to the fact that the Ferry-bound traffic is relatively light, averaging for the hour only 69% of the seating capacity, *i. e.,* one-third more seats than passengers. But it is not deemed proper to include in the final analysis this transbay commuter traffic *to the Ferry,* for the reason that it is handled almost entirely on inbound cars and has no bearing on the outbound city service.

It is necessary to state here that the above percentage loadings, while apparently fair considered on the rush hour basis, are, in reality, entirely too high. It has already been pointed out that the ratio between rush hour and base midday schedule indicated too low a rush hour service standard. These throat counts fully confirm this conclusion. In modern urban transportation, where the rush hour load much exceeds 133% of the seating capacity on an average, excessive standing results. Here the rush hour average of city-bound traffic is 158%, or nearly 20% higher.

Analysis by Periods. The serious nature of the existing service on some of these important lines will be apparent from the following comparison of loading percentages:

Trunk or Routes.	Full Hour.	Maximum Half-hour.	Maximum Quarter-hour.
Market Street	206	215	232
Mission Street	212	230	235
Sutter Street	190	194	204
Folsom Street	144	180	194
Turk and Eddy	171	180	188
Mission and Twenty-fourth	230	262	270
Cemeteries	222	241	271

These relations are more striking when shown graphically for successive 15-minute periods. (Fig. 26.) The maximum crest of travel clearly occurs in the second period for city travel only, while travel to the Ferry decreases steadily after five o'clock.

Carrying this analysis to a finality, *i. e.,* to single cars, it is found that extremely severe loading occurs on many lines to an extent of which the usual operating records available give no indication. For example, 23 trips on various routes showed over 200% loading, three trips over 300% and one as high as 383% loading. However, individual trips cannot be taken as a fair basis for computing service standards unless in conformity with the average record of the period.

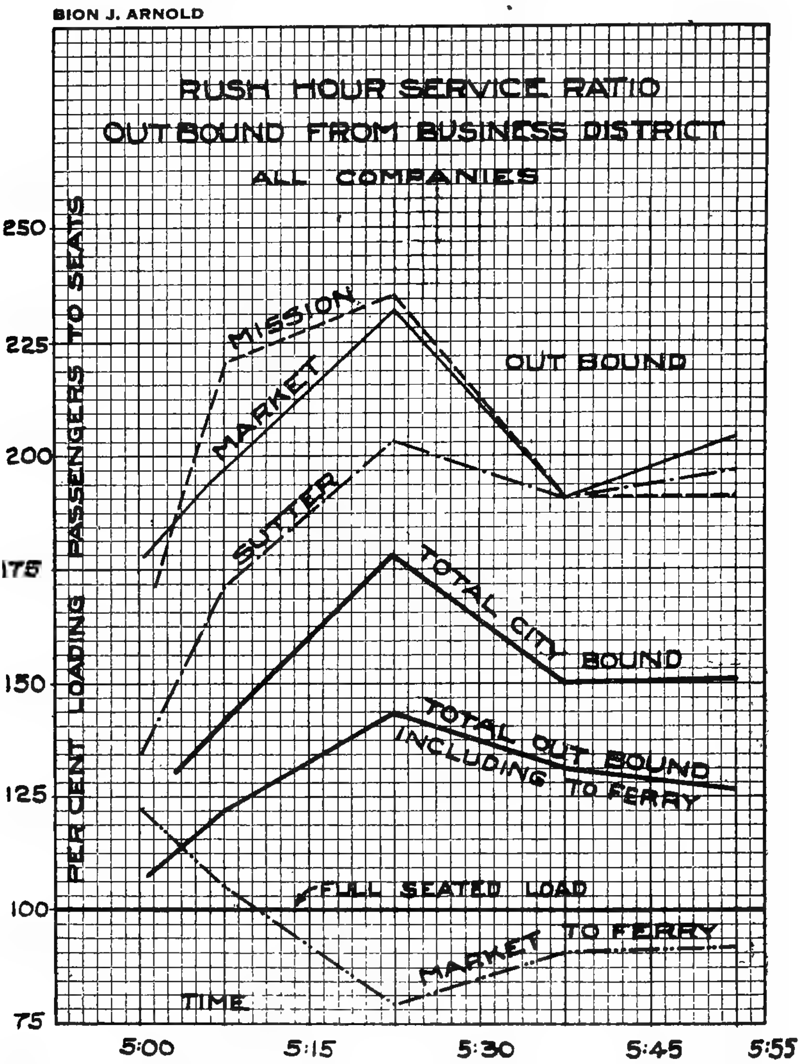


FIGURE 26.—VARIATION IN SERVICE STANDARDS DURING RUSH HOUR ON IMPORTANT THROATS.

This diagram records the average service by fifteen-minute periods expressed in per cent of passenger load to seats furnished—*i. e.,* all above 100% represents standing. This record covers every line operating out of the business district, and represents the average condition on about 600 cars operating therein during the rush hour. It summarizes in concrete figures the service standard in San Francisco for July, 1912. Since then traffic has steadily increased.

Check on Conductors' Records. The above mentioned disparity between the records of the operating department and those found by actual count may largely be accredited to the fact that it is a *physical impossibility* for any conductor to keep an accurate record of passengers or fares where continued car loading as excessive as that enumerated above is encountered. And here exists the most forcible argument for the installation of the prepayment principle on all lines.

To make sure of results, as many as five observers were stationed on the non-prepayment cars of both double-truck and single-truck type. These counts showed the following missed fares or passengers missed by the conductor on a single trip:

1 line was 90 passengers short;
4 lines were 50 passengers short;
8 lines were 25 passengers short;
13 lines were 10 passengers short.

Thus, in one case, the Kentucky Street line, during a typical rush hour period, 38% of the total registration was missed on a single car trip. In comparison therewith, only two prepayment lines showed 10 passengers or over missed by the conductor, the average being four or five, and in these two cases, the excessive crowding on the rear platform (which is against the rules of the Company) prevented the conductor from reaching the passengers clinging to the rear step.

It is therefore deemed unquestionable that the prepayment car has served a most useful purpose in securing the *proper income* that should be derived from the passenger traffic handled, which should not be considered for the sole purpose of increasing dividends, as often considered, but also *for the purpose of securing from this justly increased revenue the additional car service made possible thereby.*

New Equipment. For the purpose of a rough comparison, it is estimated that the addition of the 65 cars now under construction for the United Railroads will effect a reduction in the rush hour loading of outbound city traffic from 158% to about 138%. Thus, this new equipment will hardly suffice to bring about a proper service standard *for the present,* to say nothing of demands of the future or of the Panama-Pacific Exposition in 1915.

The exact computations of additional service required, however, should be made upon a standard car-mile or seat-mile basis, which automatically compensates for wide variations in length and speed of various routes. Detailed recommendations upon this subject will be made in Chapter 7—"Rerouting and Service Redistribution."

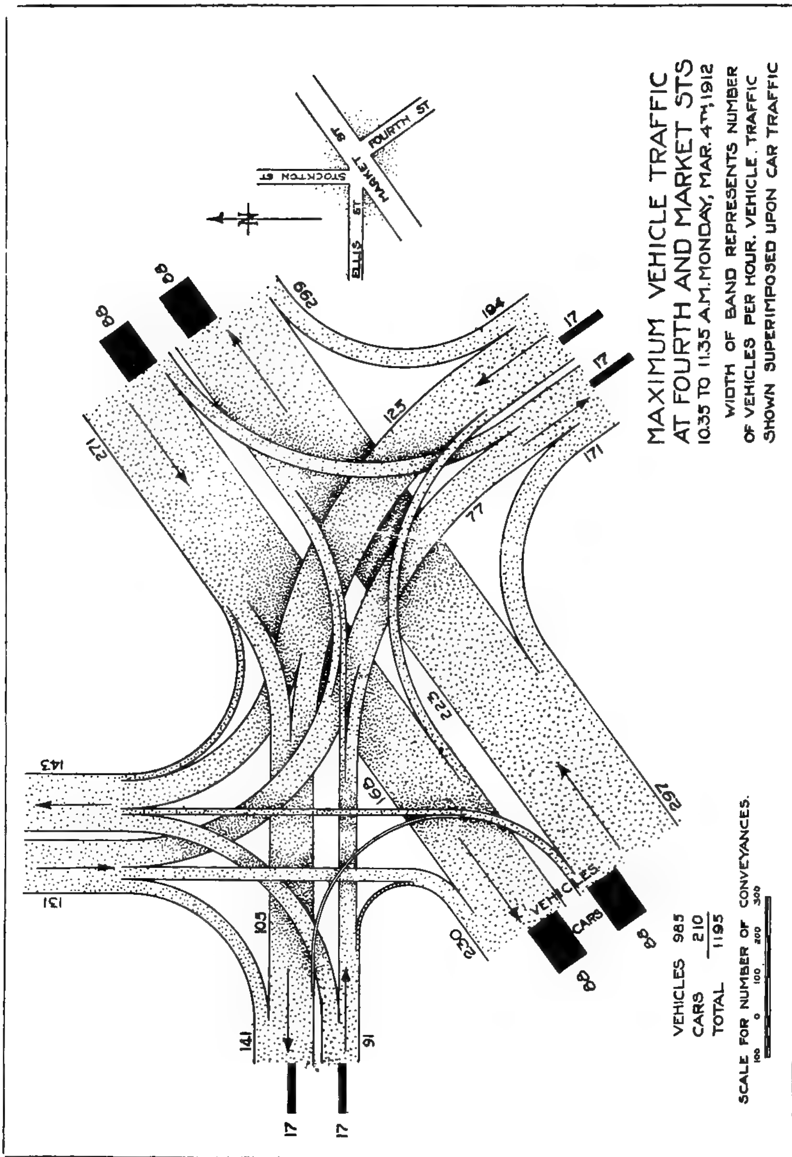


FIGURE 27.—FLOW OF VEHICLE TRAFFIC, MARKET STREET.

Results of vehicle traffic count at Fourth and Market Streets, showing graphically the volume and complexity of traffic flow at a typical congested center; also the necessity of efficient traffic regulation. Market Street traffic clearly should have preference over transverse traffic. While vehicle traffic at this time was maximum, car traffic is 50% higher during rush hours.

CHAPTER 6

RELIEF OF TRAFFIC CONGESTION ON LOWER MARKET STREET*

Methods of Operation
Development of Four-track Operating Plan

The peculiar street layout of San Francisco, by which all of the Western Addition streets branch from Market Street, and the absence of any parallel thoroughfares to the north, naturally result in extreme congestion of the one important artery. Furthermore, the present methods of car operation cannot provide maximum capacity with minimum congestion. In this chapter, traffic conditions are analyzed and various methods for relief are recommended in detail, covering that portion of lower Market Street from McAllister Street to The Embarcadero. Chapter 13 develops the necessities of the Ferry terminals and their reconstruction and enlargement.

In perfecting plans for the relief of lower Market Street, distinctly shown to be so necessary in the preceding study of the downtown district, consideration has been given herein to the following subjects: Traffic regulation; car and passenger distribution; location and sources of transit delays; street capacity; loading speed; physical obstructions; intersecting lines; arrangement of tracks; safety stations; assignment of stops, present, proposed and alternative; shelters.

From the above, it will be observed that this report relates to the physical conditions and the operative problems only, and has no bearing whatever upon any question of *franchises or litigation* involving the outer tracks in lower Market Street.

RECOMMENDATIONS

1. Encourage and extend the work of the traffic force.
2. Reserve, for heavy vehicle traffic, one street through the Mission parallel to Market Street, and one or more crossing Market Street through the wholesale district.
3. Right-of-way should be determined by relative amount of pedestrian and car traffic at important intersections.
4. Reduce car traffic crossing Market Street throat during rush hours to a minimum, *e. g.*, at First Street.

*Formerly Preliminary Report No. 6, submitted Oct. 30, 1912.

5. Average loading speed of cars must be increased.

6. Use both ends of the cars at the Ferry for loading at least during periods of maximum travel.

7. Rearrange safety stations with seats elsewhere than opposite entrances and exits.

8. Extend stations to accommodate two cars at designated points of heavy travel.

9. At the heaviest traffic points—Third Street and Fourth Street—two cars should berth and cross together, tandem fashion.

10. Establish only "near side" stops on electric lines within the business district.

11. Distribute stops as uniformly as possible to permit rapid running.

12. Eliminate as many unnecessary or special stops as may be consistent with the varying local demands of passenger travel.

13. Out-bound stations are more necessary than in-bound; the latter are only required within districts where Ferry travel originates.

14. Avoid out-bound and in-bound stations located in opposite position.

15. Designate all stopping points definitely by fixed signs.

16. No considerable increase in the use of the inner tracks on Market Street can be recommended under present conditions and routing.

17. Use of outer tracks should be limited to preserve the proper ratio of car traffic on inner and outer tracks. Minimum headway 45 seconds.

18. Four-track plan A, best suited to immediate needs, is recommended.

19. Establish definite rules for stops with regard to cars passing on parallel tracks.

20. Commence proceedings for the recession of the protruding corner of Sacramento and East Streets.

21. Water-front terminal will require modification to better fulfill the fluctuating demands of ferry traffic.

GENERAL DISCUSSION

Traffic Regulation. The plans which the Police Department put into effect throughout the congested district under the supervision of the traffic force, I consider to be most important, and should be heartily encouraged by all your citizens as one effective means of reducing the traffic congestion on lower Market Street. The appended diagram, Figure 27, representing graphi-

cally the present conditions at a typical congested intersection—Fourth and Market Streets—will give an idea of the complexity of vehicle routing, with which street transportation companies have to contend. This will also illustrate the necessity for the institution of the *traffic signal* at such intersections, in order to permit the most rapid interchange of vehicles by *selective routing*. I understand that the installation of the selective signal will be extended to all the more congested intersections along Market and Mission Streets, and to other important intersections, such as Kearny and Sutter Streets, and I believe that such a system will result in maximum benefit, as has been proved in other large cities.

I am informed that before the traffic force was organized, there were approximately 1,600 vehicles per hour observed crossing at Fourth and Market Streets, and that fully 70 per cent of the vehicles using Market Street were "empties," a great majority of which were found upon this street not by reason of necessity but purely *by preference*. As a result of the operations of the traffic force, the number of vehicles intersecting at this location had been reduced to less than 1,000 by actual count in the early part of 1912. The appended diagram shows 984 vehicles, exclusive of street cars. Fortunately this vehicle traffic is somewhat less during the evening rush hours than during midday, so that the increase in car traffic is a little less serious than if vehicle traffic also increased proportionately thereto.

On account of the unavoidable necessity of utilizing Market and Mission Streets primarily for passenger travel, it will be desirable for you to reserve as far as possible for vehicle traffic one street parallel thereto. Howard Street is the natural choice, and I am pleased to confirm the selection of this street by your traffic force for this purpose. By the general use of Howard Street as the main trucking thoroughfare from The Embarcadero to the business center, traffic conditions will be improved, as soon as the construction work being carried on upon this street is completed. The perfection of the work of the traffic force should be encouraged in every possible way by both pedestrians and teamsters.*

Similarly, Battery-First Streets and Front-Fremont Streets should be reserved as far as possible as trucking thoroughfares, in order to relieve Montgomery Street, which is extremely narrow, and Kearny-Third Streets, which are indispensable for passenger and car traffic.

The Embarcadero should be improved and maintained in the best possible condition so as to encourage its use for the heavier trucking. And in this connection, the recent action of your Board in tak-

*This reservation of Howard Street is only necessary as far as the business center; beyond Fifth Street it is required for routing important car traffic.

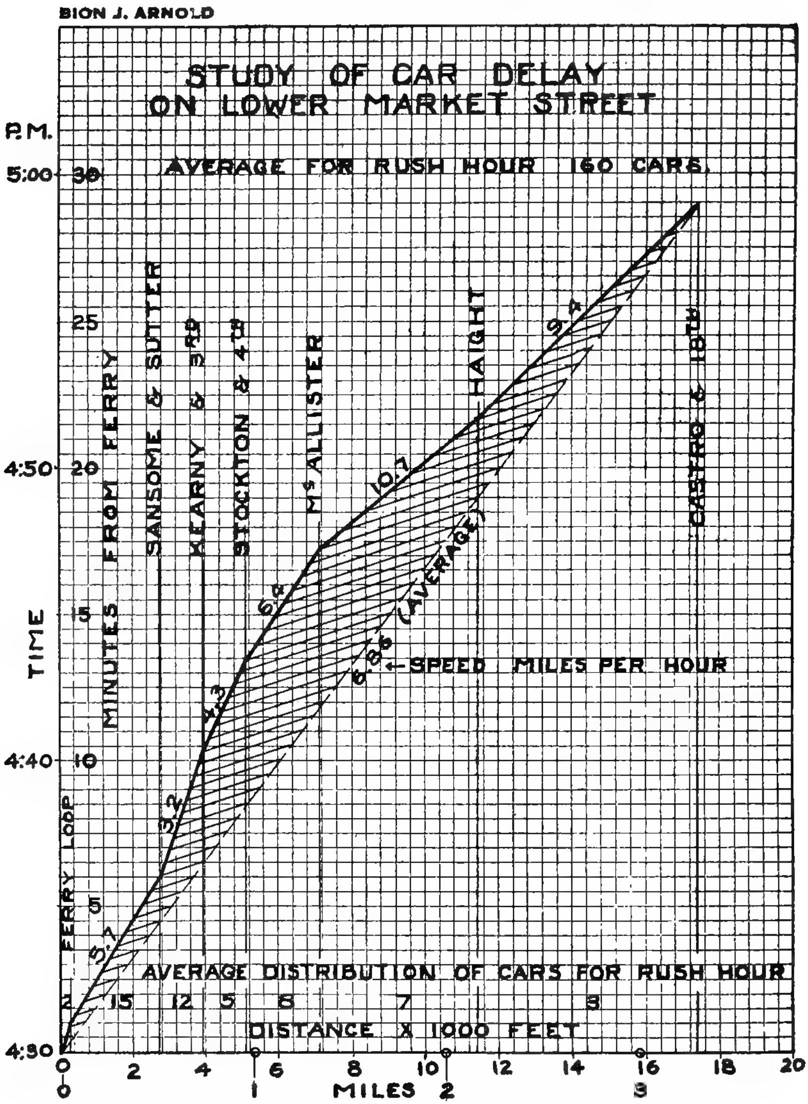


FIGURE 28—CAR CONGESTION, LOWER MARKET STREET.

Graphical study of car delay showing where the congestion occurs along Market Street, as indicated by the slowing of the schedule. Note the hump between Sutter and McAllister Streets—minimum speed 3.2 miles per hour. This represents average results from 160 cars counted during a typical evening rush hour.

ing steps to open Berry Street deserves commendation as a means of facilitating this plan of *diverting* all unnecessary vehicle traffic from the congested intersections along Market and Mission Streets.

Car Distribution. The location of centers of congestion can be shown very accurately by observation under heavy traffic. Typical conditions now existing during the evening rush hour along Market Street are represented by the appended diagram, Figure 28, and the following data obtained therefrom by averaging the running time of 160 cars out-bound from the Ferry between 4:30 and 6:00 p. m. These conditions were perhaps slightly aggravated by the construction work in progress on Howard, Second, and Market Streets; but, nevertheless, they are liable to occur at any time when congestion is not promptly controlled.

Outbound Run	Time Interval	Total Running Time	Speed, Miles Per Hr.	Cars on Street	Distance Feet
Ferry to Sansome (Sutter)	5′59″	5′59″	5.7	17	2660
Sansome to Kearny (Third)	4′20″	10′19″	3.2	12	1210
Kearny to Stockton (Fourth)	3′11″	13′30″	4.3	5	1210
Stockton to McAllister (Sixth)	3′41″	17′10″	6.4	8	2080
McAllister to Haight (Valencia)	4′29″	21′39″	10.7		4220
Haight to Castro and Eighteenth	7′14″	28′53″	9.4		6010
Total					17390

Average speed, Ferry to Eighteenth Street, 6.86 miles per hour.

In the most congested run, from Sansome to Kearny Streets, there was an average car spacing of about 100 feet, or only about twice the length of a standard car. The crux of the problem is to be found at Lotta's Fountain—Third, Kearny and Geary Streets —where both Market Street tracks are crossed by the Third and Kearny lines. Here the delays occasioned by crossings are aggravated to the maximum degree by reason of the *concentration of passengers within so limited an area,* especially during the evening rush hour. This has the effect of slowing the entire schedule *for some distance back.* To a somewhat less degree the Fourth-Stockton and Market Street crossing is also responsible for considerable congestion, and it appears that the *capacity of Market Street is practically dependent upon and determined by the condition of these two congested crossings.* It will be observed that the out-bound tracks are comparatively clear as far as Sansome Street, which is extremely fortunate, in view of the proposed extension of the Sutter Street service to the Ferry, thus relieving also the proposed Geary Street extension to the Ferry.

Car Capacity. The carrying capacity of the Market Street throat has been determined by numerous observations made at

Market and Powell Streets. These counts indicate that on the average about 127 cars pass out of the Market Street throat per hour, which corresponds to about 28 seconds average headway. From computations made upon standard equipment of the same type under efficient operating conditions, I believe this headway is very *close to the minimum* that ought to be considered for the inner Market Street tracks, for the reason that the several short-haul lines that use Market Street have little or no opportunity to recover by fast running outside of the business district, and the beneficial results from traffic regulation and other improvements hereafter contemplated ought to be reserved for the *improvement of the present running speed,* which is extremely low. This standard equipment is capable of operating most efficiently at a minimum headway of only about 22 seconds or thereabouts on a level unobstructed track, assuming a 10-second loading stop every 440 feet. (Equivalent to an average city block, or 12 stops per mile.) This headway, equivalent to 163 cars per hour, represents about the *maximum clear capacity of the tracks.*

The additional cars from the Geary and Sutter Street lines as contemplated would increase the total outflow from the Market Street throat at Sutter Street to about 192 cars per hour, assuming a two-minute headway during rush hours on the Geary Street line. In the present four-track plan, 63 per cent of the equipment would have to be handled on the inner tracks, *i. e.,* from Geary Street to the Ferry there would be found 28 out-bound cars* on the inner tracks and 13 on the outer tracks. Were the Sutter Street cars to be operated on the inner tracks there would result 163 cars per hour out-bound thereon during the rush hour. *As this is about the theoretical capacity of the equipment, it is obviously impossible of consideration.* Therefore, even under improved conditions anticipated for the near future, I cannot recommend any *considerable* increase of the use of the inner tracks by any more cars than at present operated. And if running conditions cannot be greatly improved now, the establishment of service on the outer tracks will only *increase rather than decrease* the difficulties of operation. As a result, it is entirely within the bounds of possibility that in the near future it may be found necessary under four-track operation to *reduce the number of cars* utilizing both the inner and the outer tracks by diverting parts of some tributary routes to adjacent thoroughfares; or else, this could be accomplished by turning back† a certain proportion of the rush hour extra cars on all north-side lines converging into Market Street, as is now done on the Turk and

*By actual count.

†Definite recommendations for the proper handling of this rush hour short-haul traffic will be found in Chapter 7 on Rerouting and Service Redistribution.

Eddy line during rush hours, this being done to remove from Market Street the additional equipment operated solely for the handling of the large volume of business traffic originating in the central loading district. In any event, there should be no attempt to equalize the traffic on the inner and outer tracks. Owing to the handicap to the inner tracks, the number of cars using the outer tracks should be kept at a minimum and not exceed about 38 per cent of the total cars using the Market Street throat. The necessity for this balancing of traffic arises from the fact that heavier traffic on the outer tracks will *prevent access to the inner tracks* and in the end defeat the ultimate purpose of the entire four-track arrangement.

Figures 34 and 35 referred to later, indicate the relative volume of car traffic resulting from the contemplated use of the outer tracks by two proposed methods.

Passenger Distribution. The above observations on car congestion are confirmed by studies of the distribution of out-bound passengers along Market Street as determined by numerous observations. These show that the heaviest *rate of loading per stop* begins at Second Street, increasing to a maximum at Third Street, thence decreasing progressively. As the time of loading is practically proportional to the volume of passenger traffic, every possible means of relief should be applied to this section of the Market Street throat, as herein recommended.

RELATIVE VOLUME OF TRAVEL
Market Street Stations
Out-bound Average Car, Evening Rush Hour

Station	Boarding Only	Total On and Off
Ferry loop	12	12
Drumm (California)	6	6
Battery-First (Bush)	8	8
Sansome (Sutter)	8	10
Second Street	7	7
Montgomery (Post)	14	16
Kearny-Third (Geary)	25	26
Grant (O'Farrell)	10	12
Stockton-Fourth (Ellis)	6	7
Emporium-Flood	6	7
Powell-Fifth (Eddy)	12	17
Mason (Turk)	4	5
Taylor-Sixth (Golden Gate)	4	5
Jones (McAllister)	2	2
Larkin-Ninth (Hayes)	3	5
Church-Fillmore (Fourteenth)	3	6

Note heavy loading at Kearny Street.

Sutter Street Stations
Out-bound Average Car, Evening Rush Hour
(Sutter-California, Sutter-Clement, Sutter-Jackson)

	Boarding	Alighting	Total
Sansome	30		30
Montgomery	14		14
Kearny	28		28
Grant	9	1	10
Stockton	4		4
Powell	15	3	18
Mason	1	2	3
Taylor	1		1
Jones		1	1
Leavenworth		2	2
Hyde	2	1	3
Larkin		2	2
Polk	8	10	18
Van Ness		1	1
Franklin	1	2	3
Gough	1	4	5
Octavia		5	5
Laguna		1	1
Buchanan		4	4
Webster		1	1
Fillmore	8	19	27
(Sutter-California, Sutter-Clement, only)			
Divisadero	2	7	9

North Side Traffic Distribution. Similar observations of riding habit on north-side lines converging into Market Street further confirm the statement that there is no necessity for all of the north-side cars which run into Market Street continuing to the Ferry during rush hours. The above results from traffic counts on Sutter Street will illustrate this point. These results show that the heaviest rush hour loading originates west of Sansome Street. This, taken in connection with the fact that Market Street lines do not pick up their heavy outbound loads until Second Street or Third Street is reached, proves that much of this north-side traffic could be efficiently handled by short-haul "tripper" extras looping back at the intersection with Market Street. This applies equally to the Geary Street and Sutter Street lines, and it will be found that such a plan will not only save car-miles for use on that part of the line where needed, but will also automatically relieve the congestion on lower Market Street.

Minimum Headway. Until further experience has been acquired with the operation of this contemplated four-track plan, it appears to me that the most feasible method of conserving the maximum usefulness of all the tracks on Market Street is to place a limit on the number of cars that may be operated thereon. Considering the proper proportion of traffic between inner and outer tracks as above discussed, I believe I can safely recommend that an aver-

age headway of less than 45 seconds should not be seriously considered for the outer tracks—that is, 80 car-trips per hour—as compared with the present headway of 28 seconds, or 127 car-trips per hour, on the middle tracks. This applies to the present type of motor car equipment and might very readily change if more powerful motor cars were later put into operation. It is somewhat uncertain how many car-trips per hour will be required to the Ferry via Geary Street especially in view of the possibility of additional municipal lines desiring to use the Geary Street and outer tracks. But, as the general theory upon which these outer tracks are used is that of equal participation in maintenance and receipts, I should consider it reasonable that the Municipal and the United Railroads lines, respectively, should be permitted to share equally—that is, up to a headway of 90 seconds, or 40 car-trips per hour.

Obviously, as far as the Market Street traffic conditions are concerned, it is immaterial what routes contribute to this total utilization of the outer tracks, but it is important that the respective operating departments of the tributary systems should co-operate in harmonizing their schedules, in order to secure the maximum resulting service for the patrons from the Western Addition. While short-haul routes may relieve Market Street on days of exceptional travel or during emergencies, it is quite likely that the utmost use of both outer and inner tracks would be demanded, in which event, the above-mentioned minimum headway of 45 seconds could be somewhat reduced under proper authorization from the City, but such permission should be contingent upon close co-operation of the respective operating departments with regard to schedules and the overlapping of authority of their street traffic inspectors.

Loading Speed. Preliminary observations on a large number of cars indicate that the average *speed of loading* in seconds per passenger is low, unfortunately, in San Francisco. This condition can undoubtedly be remedied by certain improvements in platform arrangements,† but nevertheless the results indicate that every possible facility must be afforded that will increase the loading speed, especially when large groups of passengers—15 to 50 or 60—are to be loaded at one stop. This condition becomes most serious at the Ferry loop terminal, referred to later, which will require special treatment. Here, 10 passengers board the *average* car during the morning hours, which is about twice as many as for the average stop along Market Street.

†Discussed in Chapter 9 on Improvements in Existing Rolling Stock.

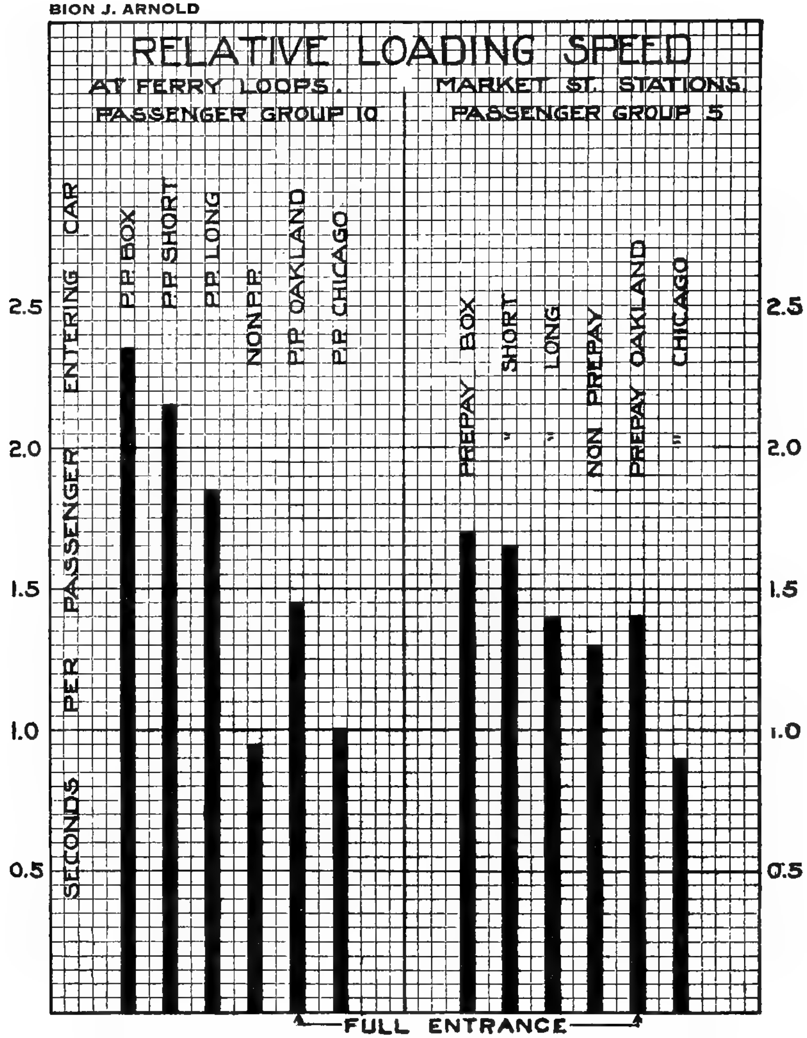


FIGURE 29—COMPARATIVE STUDY OF CAR LOADING SPEEDS.

Showing relative time consumed per passenger for various types of cars, including the newer Oakland cars with movable guide-rail. The average group of passengers at the Ferry and on Market Street was determined by actual observations. This clearly indicates the superiority of the Chicago standard car design.

The extent of the handicap under which present equipment is being operated may be judged from the fact that the largest San Francisco cars, for groups of 10 passengers, require about 27.5 per cent more time per passenger to load than the latest type of car operated in Oakland, where the radius rod is in use that permits the full length of step to be used for entrance. Figure 29 indicates this relation graphically.

One immediate remedy for slow loading at all points of heavy traffic is that both ends of prepayment cars be thrown open for loading, with an extra conductor at the forward end vestibule to receive and register fares. This method is now employed during Sunday excursion traffic at the Ferry and at other heavy terminals, and should be put into effect along Market Street.

Physical Obstructions. One very apparent cause of this slow loading exists in the present arrangement of safety stations, the majority of which are approximately the same length as the car, so that the station seats are directly *opposite the car entrances and exits,* thus greatly impeding the passenger flow. This impediment is confirmed by comparative observations of loading speed taken at the safety stations and upon the level street under the same conditions. In this respect, the stations are found to require a loading time about 13 per cent in excess of that of the street level. If seats are required at all, this can only be remedied by locating the seats opposite the center of the car berth instead of at the ends, as indicated in Figure 32.

Whatever plans are carried out in rearranging tracks at the Ferry loop, steps should be immediately taken to set back the triangular corner of Sacramento Street and the The Embarcadero, which makes it necessary at present for the Sacramento Street car tracks to enter upon and thus interfere with the main Market Street loop. I understand that unsuccessful efforts have previously been made to effect this improvement. But, in spite of this, I strongly endorse the improvement as one of the first steps in the relief of the Market Street throat. At the same time, a recession of the opposite corner could be carried out *to advantage* in order to open the throats of the loop and distribute pedestrian travel crossing The Embarcadero.*

Intersecting Lines. With the increasing traffic occasioned by the Sutter and Geary Street cars, it will be necessary to limit, interference from transverse car traffic at intersecting streets *to the minimum,* particularly at Third Street and Fourth Street. I understand that during the rush hours it is the present practice of

*Methods of improving the Ferry terminal are taken up in Chapter 13.

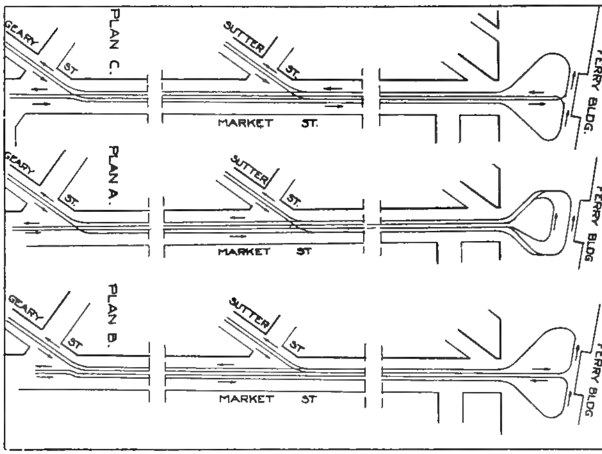


FIGURE 30—ALTERNATIVE ARRANGEMENTS OF OUTER TRACKS.

Possible track connections for accommodating four-line traffic, showing two alternative plans for minimizing car interference: A, parallel flow plan as recommended; B, counter flow plan, avoiding all branch-off crossings; C, parallel flow plan, avoiding one line of crossings.

the railway company with certain of the west-bound routes that have heretofore utilized or crossed Market Street tracks, to "short-run," beginning the route at the Market Street branch-off; for example, the Turk-Eddy and Hayes-Ellis lines. While this undoubtedly discommodes some passengers, I believe it is, on the whole, justifiable in view of the transfer facilities available. The Third Street crossing is the most serious problem, and will require prompt and efficient handling to secure effective results.

The First Street crossing should be entirely abandoned, cars stopping at the easterly line of First Street, at least during rush hours.

Track Arrangements. There are three possible arrangements of tracks on lower Market Street which could be used to accommodate both the Market Street and Geary-Sutter Street traffic. Referring to Figure 30:

Plan A, *parallel flow:* Using present Ferry loop and with branch-offs from the outer tracks. Here every inbound car on Geary and Sutter Streets must cross the entire throat, holding up all in-bound and out-bound cars thereon.

Plan B, *counter flow:* Market Street lines may be separated entirely from the Geary and Sutter Street lines by using the right-

hand pair of tracks exclusively, with an individual Ferry loop. This plan necessitates a rearrangement of loops at the Ferry in order to avoid the same interference as it is sought to avoid along Market Street. It has the marked advantage that lines converging from the north side of Market Street *do not occasion any interference* with the through Market Street lines as in the other two plans. But it also has disadvantages: first, alternate lines of traffic along Market Street with increased danger of accidents; second, the necessity of spreading tracks at stations; third, the unbalancing of car traffic. These are discussed later, in detail.

Plan C, *parallel flow:* branch-offs from the first and third instead of from the first and fourth tracks. Here, in-bound Geary and Sutter Street cars reach the Ferry by the *inner* track, thus *avoiding one line intersection* but with two still remaining. This arrangement could be handled by the present Ferry loop with slight modification, or by the rearranged loop shown. It would necessitate Geary Street cars using one track of the United Railroads lines.

Cross-Section of Street. There are four possible arrangements of cars and safety stations with the present four-track layout along Market Street.

Referring to Figure 31, the sketch shows:

(1) *Present two-track* arrangement above or south of Sutter Street, with a 21-foot clear roadway, measured to the curb.

(2) *Present four-track* parallel flow arrangement below Sutter Street, without safety stations, allowing 16½-foot clear roadway with room for two vehicles to pass while passengers are loading.

(3) *Counter flow* arrangement with internal safety platforms utilized by both in-bound and out-bound lines. Obviously out of the question.

(4) *Counter flow* arrangement showing impracticability of two stations on a four-track arrangement except in an enlarged part of the thoroughfare.

(5) *Counter flow* arrangement with central platforms suited for entrance and exit, both lines. Cars on the outside tracks are to be loaded from the street. This is a possible arrangement.

Of the above arrangements, Nos. 2 and 5 only may be considered as practical. They correspond to Market Street Plans A and B, Figure 36. In No. 2, platforms cannot be used to advantage, and passengers entering or leaving cars on the inside tracks must hold up the entire line of cars on the outside tracks. In No. 5, it is necessary to widen the present "devil-strip" at stations. For a platform width of six feet, the tracks will have to be spread two feet on each side, or four feet total. However, this spreading may be done opposite the triangular plazas in Market Street so as not to contract the roadway on the south side of the street as shown in Plan B. But in the center of the street, the platform thus becomes a real *safety station,* as well as a loading station.

Safety Stations. The present safety stations vary in length from the length of one car up to 70 feet, including seat and electrolier at each end. Apparently they were designed for shorter cars than now regularly operated over the lines of heavy traffic. As previously indicated, this seat arrangement is entirely improper, and I should recommend that the platforms be modified either by concentrating the seating opposite the middle of the car or by extending the platform. In a number of instances, stations of larger capacity than at present available are, in my judgment, badly needed, and Figure 32 shows the general dimensions* of these proposed enlarged stations, which will accommodate two cars at once, with a space between fenders for interchange of passengers. The platform proper is only required to be of sufficient length to serve the entrance and exit steps of the car platform, although a few feet additional length would serve a useful purpose in accommodating passengers *bunched* at the entrances. A substantial electrolier at each corner of the station exposed to traffic provides some protection to standing passengers; consequently no cement barrier is shown as in the present stations. But, it may be advisable to carry a six-inch step around the outside and ends of the station to serve the double purpose of assisting passengers to ascend and to protect waiting passengers from the hubs and wheel guards of carelessly driven passing vehicles. Side seats are shown in this sketch, but as standing space is so valuable, it is perhaps a question whether it is advisable to continue their use.

Profiles of the various types of cars operating along upper Market Street show a maximum variation of two inches between the widest and narrowest car steps. This permits of a platform built more nearly to the step level than at present. Figure 33 shows the

*Safety stations may be shortened 2½ or 3 feet if exit doors from forward car platforms are located next to the car body or bulkhead, as in the Geary Street cars, instead of next to the bumper, as in the Market Street cars.

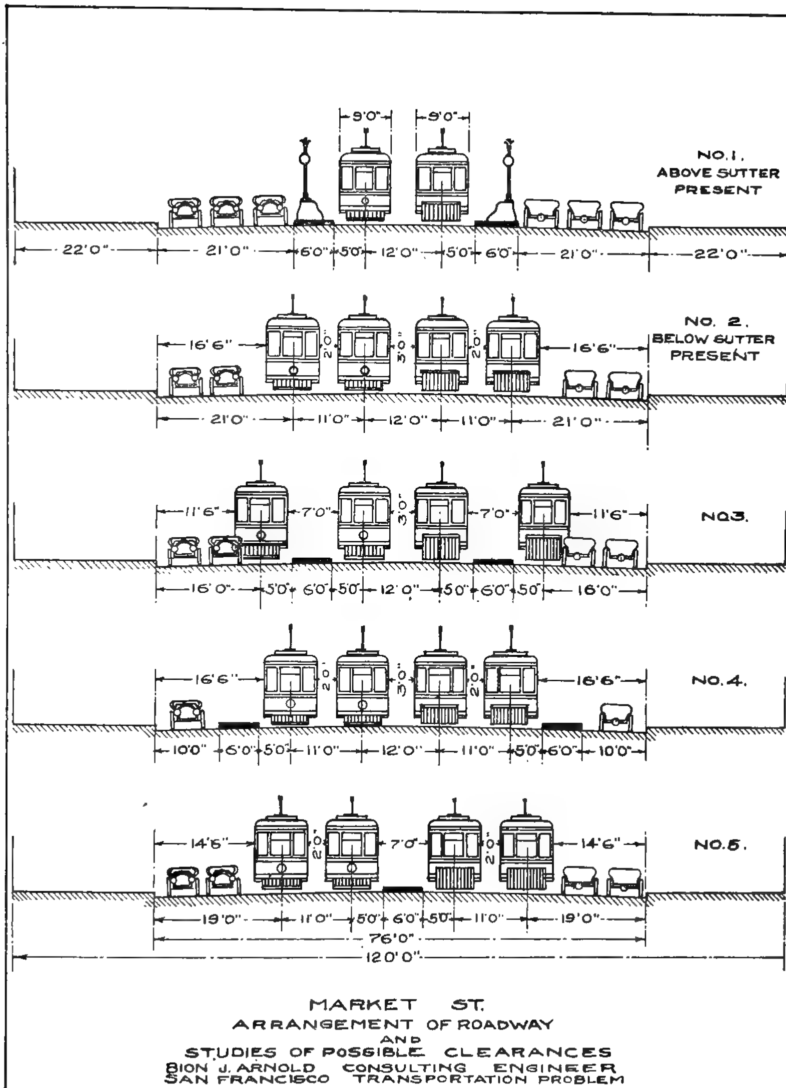


FIGURE 31—POSSIBLE ARRANGEMENT OF SAFETY STATIONS.

Typical cross-sections of Market Street, showing possible station arrangements resulting from different four-track plans—A, B and C, Fig. 30. Of these only Nos. 2 and 5 are practicable. The former is recommended.

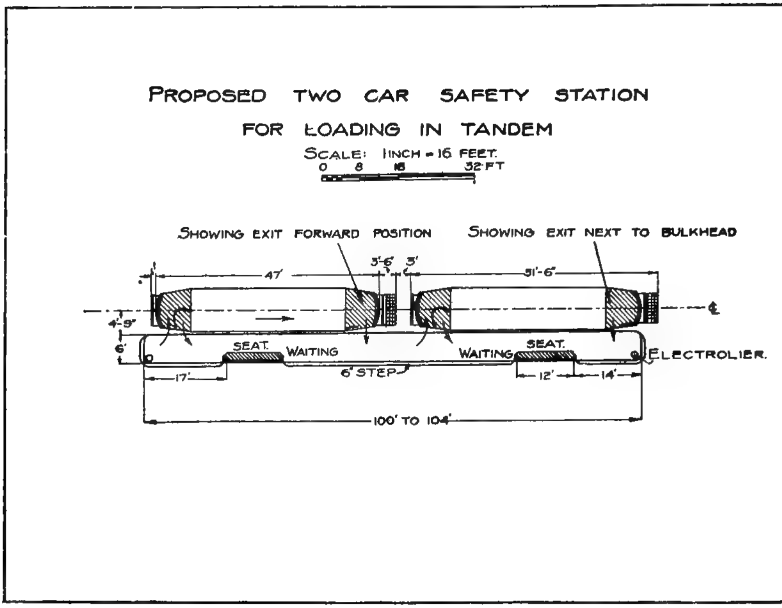


FIGURE 32—SAFETY CAR STATIONS, MARKET STREET.

Recommended rearrangement of safety station for accommodating two cars simultaneously, first car arriving to take the forward berth. Step built around outside of station for protection to waiting passengers. Seats are optional, but free passage ways opposite car platform are essential. Note that stations may be shortened if front exit gates are next to car bulkheads.

present clearance conditions between platform and stations. As standard equipment will probably not employ a drop step lower than 14 inches from the rail,† I believe the station could be built to a height of 10 inches to advantage, and with a minimum of two inches clearance outside of the widest step. This additional height will tend to prevent persons attempting to stand on the ground level, and to facilitate entrance.

Seat Flow. A graphical impression of the relation, disposition and volume of car traffic on Market Street and branch streets by these trackage Plans A and B, is afforded by the diagrams, Figures 34 and 35 showing the number of seats passing a given point during the rush hour. Figure 35 shows the entire avoidance of car interference along Market Street by the Geary and Sutter Street lines, Plan B.

Assignment of Stops. The plans proposed herein for locating stopping points and operating four tracks in lower Market Street involve the following essential principles:

†To the step tread.

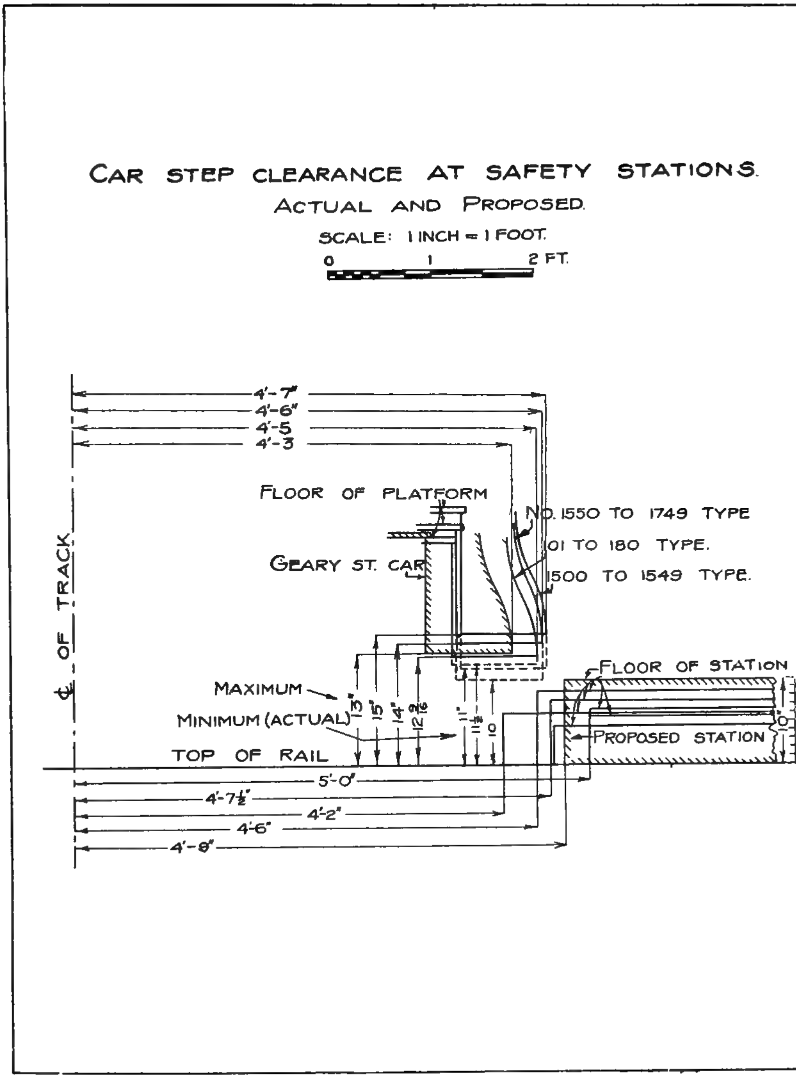


FIGURE 33—COMPARATIVE STUDY OF CAR STEP CLEARANCES.

Diagram showing present variation in step clearance at safety stations along Market Street, due to different types of cars and station designs, also the position of station as recommended.

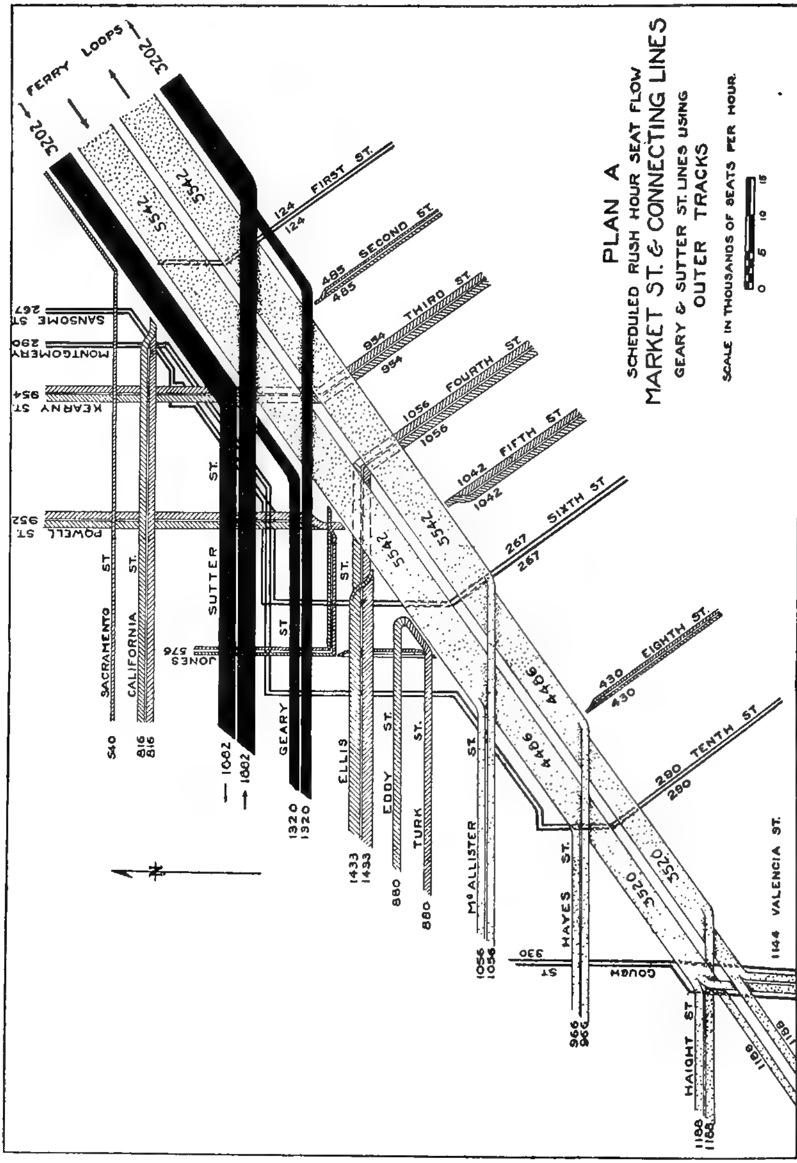


FIGURE 34—CARRYING CAPACITY OF TERMINAL LINES, PLAN A.

Diagram indicating relative distribution of seats in the vicinity of Market Street during a typical rush hour. Width of band is proportional to number of seats passing a given point per hour. Geary and Sutter Street traffic as contemplated is shown in heavy black for comparison. This diagram represents trackage Plan A as recommended, and gives a measure of the interference resulting from four-track operation.

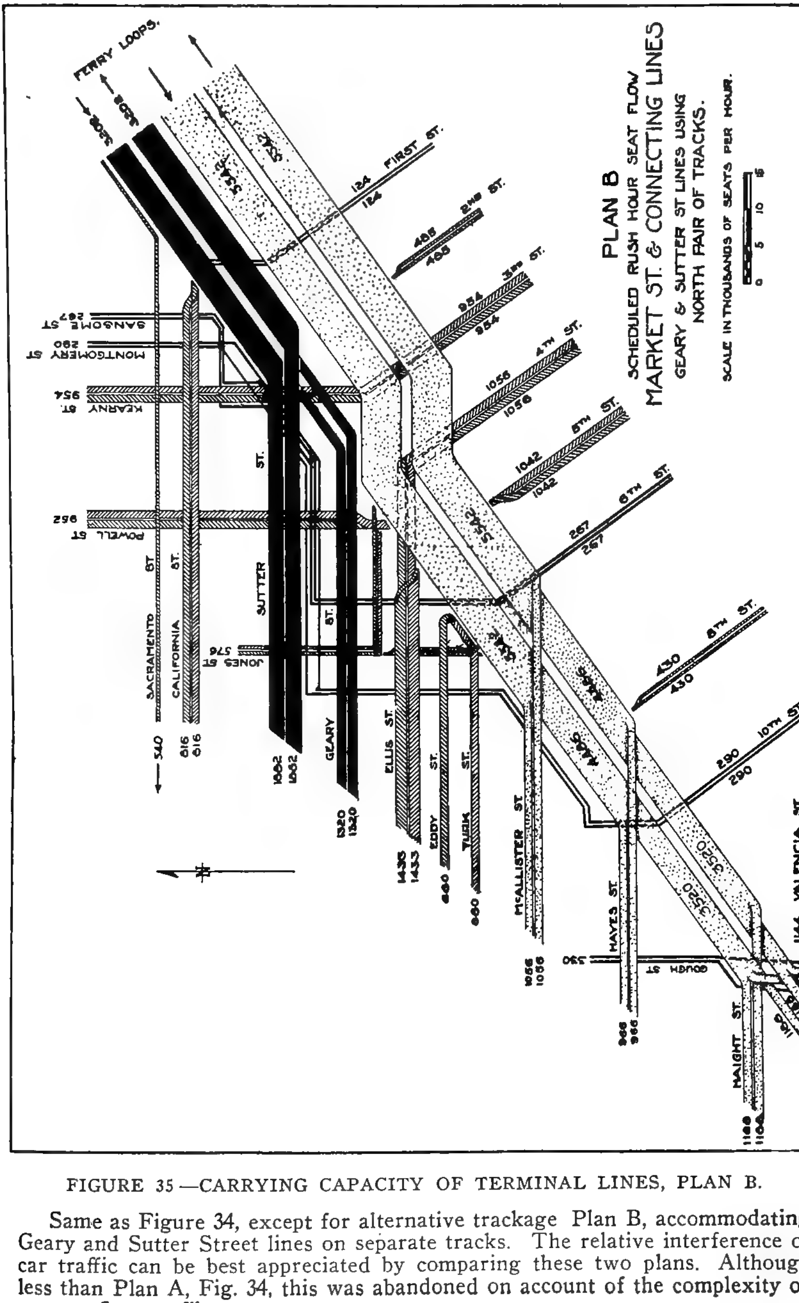


FIGURE 35—CARRYING CAPACITY OF TERMINAL LINES, PLAN B.

Same as Figure 34, except for alternative trackage Plan B, accommodating Geary and Sutter Street lines on separate tracks. The relative interference of car traffic can be best appreciated by comparing these two plans. Although less than Plan A, Fig. 34, this was abandoned on account of the complexity of counter-flow traffic.

(1) That car stops should be distributed as *regularly* as possible along the street in order to secure the most effective car operation, *i. e.*, acceleration, coasting and braking.

(2) That the distance between stops should be increased to a maximum consistent with convenience of the *majority* of patrons and the varying local demands of passenger travel.

(3) That provisons be made for two-car or *tandem crossings* at intersecting streets where congestion of traffic is sufficiently serious to require traffic regulation and the whistle signal.

(4) That stations at such points be designed for tandem stops, so that loading and unloading may be done simultaneously without retarding the entire line of traffic by cars berthing singly as at present.

(5) That "free way" for vehicle traffic across intersecting streets should not be interfered with by locating the stops so as to constitute a *source* of congestion.

(6) That, during rush hours, the right-of-way across Market Street be *proportioned* approximately according to the relative volume of passenger and car travel.

(7) That definite stopping places be designated by posts or by signs suspended from the trolley span wires supplemented by signs in the pavement, so that patrons may know *exactly where cars are to stop,* thus avoiding confusion.

(8) That safety loading stations are only needed where passengers are required *to wait for a particular car* for any length of time.

(9) That branch lines should berth off of Market Street as soon as the intersection is reached.

In applying these principles, the institution of the "near side" stop becomes necessary at least within the congested zone, except in special cases of "blind" street intersections. The rule may be waived in the case of the blind side of a cross street. In the interests of safety, cars are now required to stop at all special work intersections over which cars are regularly operated and also at all leading switches. It follows, therefore, that they should not be required to stop also at the *other* side of the crossing, but, once across, should be given the right-of-way to the next "near side" intersection in order to clear the track for succeeding cars. This will eliminate certain of the present stopping points, unavoidably.*

*For each unnecessary stop eliminated, the schedule speed can be increased 5.6 per cent. under San Francisco conditions, assuming that cars now stop at every corner averaging 440 feet apart, or twelve stops per mile. The average distance on Market Street is now even less than this.

Plan of Stops. ‡ The accompanying drawing, Plate 10, embodies the above principles, applied to trackage Plan A as recommended. This may be compared to the present plan of stops, Figure 36. In the appendix hereto, these plans are discussed in detail, with the reasons for such changes as are recommended. Each station stop, flag stop and safety stop is designated by a car in position. Ordinarily, not all of these stops would have to be made. Cautionary stops are also indicated. The present safety stations at Ellis and at O'Farrell Streets are removed to the east side of the crossing and several of the stations lengthened. Stops at Fremont and Main Streets, in-bound, are omitted to facilitate quick running from the business district to the Ferry and for the reason that the passenger traffic *Ferry-bound* during evening rush hours originating east of First Street is so light as to make it undesirable to delay the main line by stopping at each of these short blocks.

Plan A. In this plan, the average running distance between stops is 454 feet,† and on the average a running speed of 7.75 miles per hour from the Ferry to McAllister Street can be maintained, *assuming no* interference from *vehicle traffic* and an average stop of 10 seconds at each of the points indicated.

Within the four-track territory, cars moving in the same direction on adjacent tracks are shown in a tandem position, based upon a rule of the road that one line of traffic is not allowed to pass another in the same direction while loading or unloading. This will unquestionably be a source of *some* delay under trackage Plan A, for the reason that outer track cars will hold up those on the inner track, and *vice versa*. However, in the case of such a broad street as Market Street, it would seem possible and necessary to waive this rule to the extent that inner track cars should be allowed to *continue under cautionary running* past a car loading or unloading on the outer track. This will afford the inner tracks a certain measure of relief, much needed by virtue of the fact that these tracks are carrying the heaviest traffic. Obviously this rule is not reversible, and in all cases the *outside car must stop* while the inside car is loading and unloading. In these tandem stops, the outside car berth is shown in the forward positon—that is, leading by one car length —in order to permit access to the rear car platforms. However, the forward berth will in any case be occupied by the *first car ar-*

‡Plans discussed in detail in Appendix.

†The average distance between present stops is 368 feet; minimum distance, 137 feet; maximum, 678 feet.

riving on either outer or inner track, in order that the next arrival may berth in the tandem position shown without obstructing streets and established lines of vehicle traffic. This is important, as 100-foot berths are now under consideration in lower Market Street, and the stop signs placed along the streets for the guidance of passengers should be located with reference to the *forward* and not the rear berth.

Plan B. Working out this same idea of fixed stops with trackage Plan B, Figure 36 is a result.† Fortunately, most of the safety stations between tracks may be located nearly or exactly opposite the triangular plazas existing at Geary, Post, Sutter, Bush, Pine and California Streets. In this arrangement the average distance between stations from the Ferry to McAllister Street is 484 feet, and more rapid running is possible along the lower end of Market Street, north of Third Street, by reason of the lengthened and more uniform stops, and with a clear street a schedule speed averaging eight miles per hour could be maintained. This plan necessitates a considerable rearrangement of loops at the Ferry, the spreading of which would unquestionably increase loading facilities.

The spreading of tracks that will be necessary to accommodate these safety stations can be worked out by allowing the east side tracks to remain as they are and spreading the west side tracks into the plaza where there is ample space to avoid any interference with vehicle traffic. Although eight cars are shown at each stop, it is unlikely that such a condition will occur except *very infrequently.*

Finally, weighing the advantages and disadvantages of these two plans, in my judgment, Plan A best meets the present necessities, and it should be put into immediate effect by the construction of the necessary track and special work. Under present traffic conditions and in the absence of a supplementary rapid transit system, Plan B is objectionable from the standpoint of counter traffic flow.

Shelters. Owing to the peculiar conditions resulting from the diagonal street intersections north of Market Street, it is desirable that adequate shelter stations should be erected within the existing triangular plazas, especially at California Street where the California Street line terminates. This shelter may simply provide seats for waiting transfer passengers, or may be more elaborate, as is possible in the large plaza at Bush Street and Battery Street.

In conclusion, I can recommend a reasonable utilization of the four tracks on lower Market Street, but in accommodating Geary Street and other lines, such a plan must be worked out carefully by the respective operating departments, in order to

†Detail drawing not shown as Plan B could not be recommended.

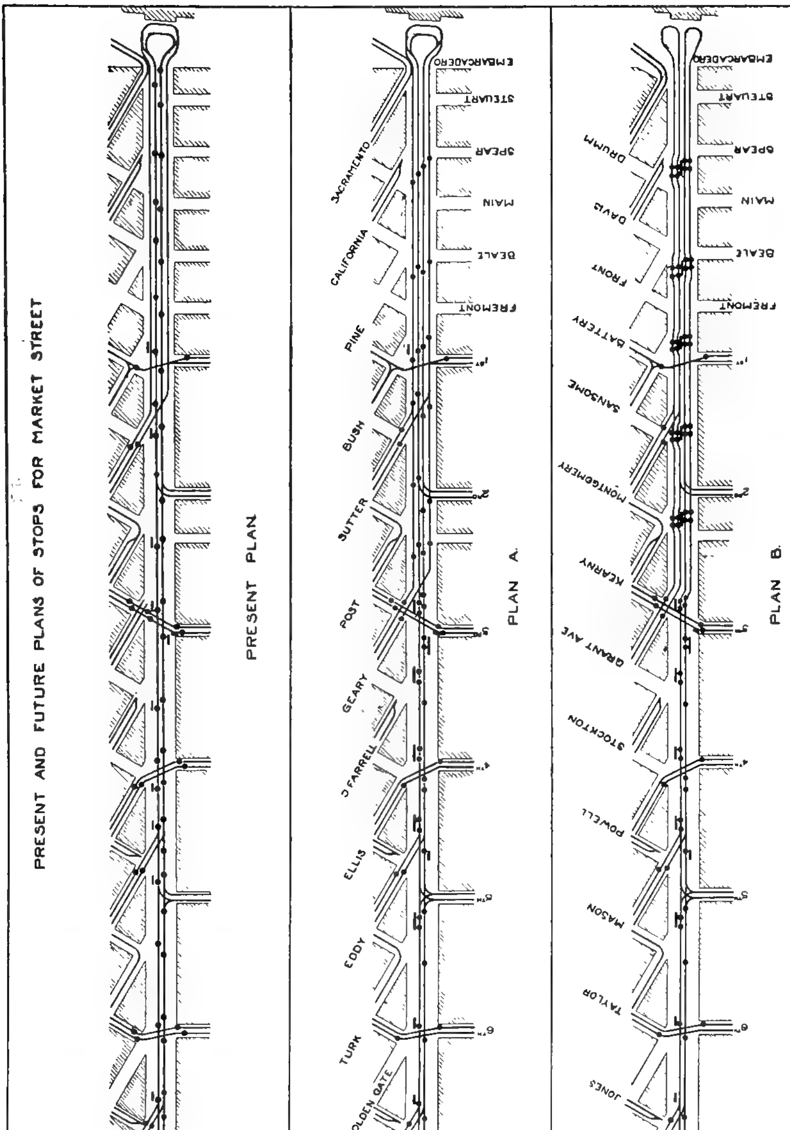


FIGURE 36 —KEY SHEET FOR FOUR-TRACK PLANS.
Plan A recommended. Dots indicate stops, single and tandem.

preserve the proper balance between inner and outer traffic, or there will result worse delay, confusion, and accidents than at present. The operating problem is by no means as simple as it appears, and in order to produce the most effective results there must be close co-operation in putting into effect operating rules for passenger, car, and vehicle traffic.

FERRY TERMINAL WITH CABLE AND HORSE CAR OPERATION, 1905.

CHAPTER 7

REROUTING AND SERVICE REDISTRIBUTION

Rerouting—Terminal District
Rerouting—Outlying District
Service Redistribution
Routing for Municipal System
General Service Improvements

A very important phase of this transportation study, from the viewpoint of the public, is to obtain adequate and most direct service between destination points; and from the viewpoint of the Company, to provide this service with the least car mileage and resulting cost. From either viewpoint, it is essential to provide for the immediate relief for the congested terminal district. In this chapter are presented detailed routing plans for both the terminal and outlying districts, calculated to relieve congestion and best serve the existing traffic by the institution of new routes as far as possible rather than by disturbing the present routes. Redistribution of service is assigned to the individual routes upon the bases of detailed traffic counts covering the entire system and the loading standards fixed for each type of car operated. An alternative system of routing for competitive municipal operation is suggested for use in the event that a unified system with the municipal railway operating in development territory is found impossible. In addition, general improvements in operation calculated to increase the speed of transit and the comfort and safety of passengers are recommended.

The Problem. To establish an efficient rerouting plan *satisfactory to all* is generally an impossibility for the reason than any changes so seriously affect the relations between various parts of the community; and therefore the best that can be done is to present a plan for public discussion and approval or modification. *It is a matter for mutual concessions rather than of individual judgment,* and local interests should not intervene to defeat a meritorious plan designed for general improvements. In this matter the various civic and commercial organizations of San Francisco should find a useful field for action. Two distinct viewpoints must be recognized:

1. Assuming the traction lines to be operated as a unified system, not necessarily under the same ownership, but recognizing the principle of *one city, one fare, universal transfers,* with the municipal system operating in development rather than competitive territory.

2. Assuming the unified system impracticable, and consequently the development of each system *independently* without interchange of transfers, and possibly with wholesale competition.

Heretofore have been considered only such factors as bear upon the question of a definite service standard without attempting to fix upon service distribution.

It now remains to determine: (a) riding characteristics of patrons from actual observation; (b) new routes by which cars can be run to better advantage; (c) specific improvements in headway and methods of operation; (d) whether this improved service is possible without unreasonably impairing net income; and finally, (e) a system of routing for the municipal railway lines.

REROUTING—TERMINAL DISTRICT

Essentially the problem of routing in the downtown loading district is one of most advantageously utilizing the streets available, which unfortunately are not laid out to best serve traffic requirements, and to make possible the *additional service* now required without causing still further congestion, especially on lower Market Street. The general principles are briefly as follows:

1. To avoid the concentration of excessive traffic on a single street, when parallel streets may be made available. A walk of *one block* should not be considered unreasonable if in the interest of effective routing.
2. To distribute car traffic according to the *capacity* and ***importance*** of the streets, and at the same time preserve most direct routing to important traffic centers.
3. To provide loops instead of stub terminals as far as possible for lines of heavy travel.
4. To facilitate collection of passengers within the loading district by "pick-up" loops for short-haul lines, especially for short lines terminating along a trunk line. Long-haul lines may properly terminate further from the center of the loading district.
5. To avoid branch-off and other intersections along very congested streets and two-way operation on single-track streets within the business district.

Capacity of Market Street. On this most congested thoroughfare, 127 cars per hour are operated on the middle tracks during the rush period corresponding to a headway of about 28 seconds. The theoretical minimum headway providing safe car spacing and reasonably efficient operation is about 22 seconds for the standard equipment used here;* but it is believed that the present headway represents about the practical minimum on such a street

*See discussion of this subject, Chapter 6—Relief of Lower Market Street.

necessarily congested with pedestrians and vehicle traffic especially with four-track operation. (See Fig. 40, present routing.)

It is therefore necessary, in formulating rerouting plans, to divert any further increase in the traffic on Market Street to parallel streets, especially rush hour trippers. At present, Mission Street is the only convenient substitute available for this purpose, as it now carries only 56 cars per hour.

These conditions, in reality, furnish a measure of the possibilities of any terminal rerouting plan in the matter of deferring the eventual construction of a Market Street subway. With the existing physical limitations, this subway must come when every other means of relief of the Market and Mission Street traffic has been exhausted. And the rerouting plan recommended herein can only be regarded therefore as a temporary means of conserving existing street capacity to the maximum possible extent, rather than what may be termed a final solution for any considerable future period.

Terminals. At the Ferry terminal, the inner loop is now being operated up to its maximum capacity, 81 cars per hour, even this often causing a line-up on the inbound Market Street tracks. In order to allow comfortable access to the inner loop, the use of the outer loop should not exceed this amount, giving a total capacity for the terminal of 162 cars per hour. When the Geary and Sutter Street lines are operated to the Ferry, the terminal is expected to handle over 200 cars per hour, but it is obvious that this will necessitate either a radical modification of the terminal, looping back extras at Market Street, or diverting to Mission Street.

The south-side stub terminal at the Ferry now operates 78 cars per hour, which *exceeds its capacity* and will continue to cause congestion if operated without a loop, which, in any event, will ultimately become necessary; and if additional service is to be run on Mission Street, extra cars must be looped back without reaching the Ferry or else stub-ended at First, Second, Fifth, and Eighth Streets, where double cross-overs should be installed. Loop terminals would probably provide the greater capacity, but the latter plan is for the present recommended, inasmuch as a large proportion of the load originating on and north of Market Street is best served in this way.

As an alternative, Market Street congestion may be directly relieved by diverting all of the traffic of an entire line from Market to Mission Street. But there appears to be only two lines logically available for this purpose: (1) Haight Street, and (2) Market-Castro, two of the heaviest lines operated. However, it is doubtful if the patrons on either of these lines would at this time consent to such a plan.

Another method of relieving both street and terminal congestion is by the use of a Market-Mission one-way loop, running inbound on Market to East, thence outbound to Mission, and return on Fifth, Ninth, Tenth, or Twelfth Streets. But in view of the unbalancing of traffic on Market Street, particularly under four-track operation, this has been reserved only as an alternative for use after the *effect* of service on the outer tracks has been determined.

Taken altogether, it appears that the stub terminal plan is preferable inasmuch as it provides Market Street service for *all lines* now using that thoroughfare, restricting traffic on the inner tracks to the present amount. As the extra cars diverted to Mission Street are stub-ended at Market Street, they are reasonably convenient to all Market Street patrons, directly or by transfer.

Capacity. The general range of capacity of various types of stub terminals is given below, necessarily subject to considerable variation according to the total number of passengers per car that have to be loaded at the terminal. On the usual single-track stub a headway of from 2½ to 3 minutes may be easily maintained with proper dispatching. If a double cross-over is installed and each of the two tracks used as a stub, this total headway may be reduced to about 1½ minutes. But where it is essential to maintain *through service over the same tracks,* as may be necessary in Ellis, Sutter and Geary Streets at Market Street, it is undesirable to use the double stub due to the obstruction to through traffic; and inasmuch as all through traffic at each of these points is routed either to the Depot or to the Ferry, where schedule trains and boats must be met, the inbound track should be cleared by stub-ending cars on the *outbound track only.* This necessarily limits the total capacity to that of a single-track stub terminal as follows:

CAPACITY OF STUB TERMINALS* FOR HEAVY LOADING POINTS, INCLUDING LAY-OVER

Proportion of Cars Through	Number of Loading Berths	Total Capacity, Cars per Hour: Even Trunk Headway	Total Capacity, Cars per Hour: Uneven Trunk Headway
None	1—Single stub	24	Less
None	2—Double stub	40	Less
½	1—Single stub	24	32†
⅓	1— " "	24	29
¼	1— " "	24	26
½	2—In tandem, single stub	24	40‡
⅓	2 " "	24	28

*Based upon the assumption that all cars stub-ending stop for two minutes and through cars stop one minute; 15 seconds required to enter or clear berths. All capacities may be materially increased by dispatching cars promptly without lay-over after loading, as is now the case at Sutter Street. Obviously, delays from lay-over time reduce stub terminal capacity proportionately. "Tandem berth" means two cars in line, as recommended for Market Street safety stations.

†Approximates present Ellis Street conditions.

‡Recommended for Ellis Street, and possibly for Geary and Sutter Street stub terminals.

Headway. The question of uniform headway depends upon the relative importance of trunk and of through lines. In cases where only one route is handled in the terminal, (part of the cars being through run) an even headway may be maintained with comparatively little sacrifice of capacity. But where the through and stub cars are of different routes, uniform headway on both trunk line and branch routes is impossible except when half of the cars stub and half route through the terminal. Where an even headway is not essential the capacity may be materially increased by the provision of two-car or tandem berths on the outbound track, and this is desirable in any event when the regular stub berth is occupied to accommodate cars after crossing Market Street. This non-uniform trunk line headway is not very objectionable with service as frequent as 2 to 2½ minutes, as in the case of most of the downtown trunk lines; but with through headway as infrequent as 4 to 5 minutes, any considerable irregularity therein is certainly objectionable.

Distribution. With the proposed terminal routing and service distribution, car traffic would be assigned to the various terminals as follows as indicated on re-routing plan, Fig. 37:

CAR ASSIGNMENTS TO TERMINALS

Service as of July, 1912	Cars Per Hour Present	Proposed
Market Street ferry terminal	127	127
Market Street outer tracks	0	40
South-side ferry terminal	78	72
First and Market stub	4	30
Second and Market stub	12	24
Fifth and Market stub	25	30
Eighth and Market stub	10	10
Eddy and Market stub	22	22
Powell and Market stub	34	32†
Ellis and Market stub	14	13
Sutter-Sansome loop	46*	19‡

The proposed plans for rerouting in the terminal district are all based upon traffic conditions of July, 1912, and therefore the car requirements are probably 3½% low. This routing is necessarily dependent upon that adopted for outlying districts, later discussed.

Haight Street service to be increased from 30 to 41 cars per hour to accommodate Beach traffic; should be split at 12th to relieve Market Street, 25 cars per hour running over the present route, and 16 via Mission Street to a terminal in First at Market Street. This routing will leave the Haight service on Market Street practically

†Assuming larger double-end equipment.
*Stub end.
‡"Pick-up" loop.

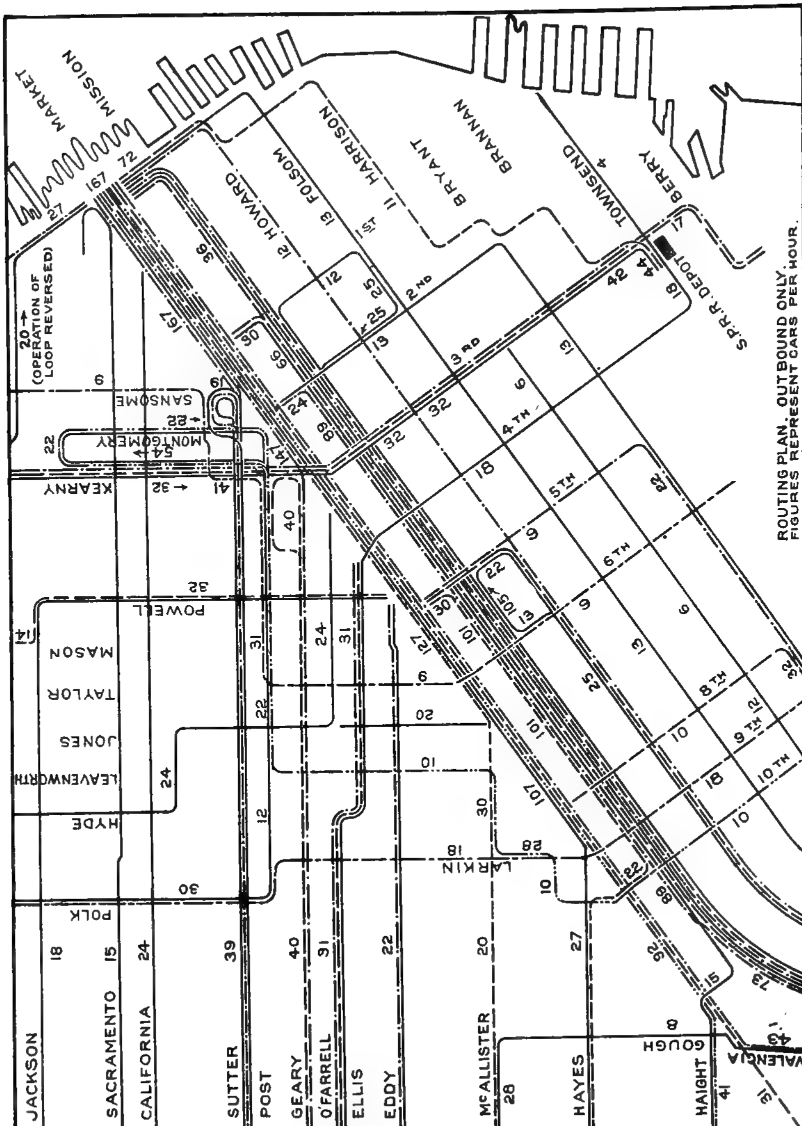


FIGURE 37—REROUTING MAP—TERMINAL DISTRICT.

The most practical method of relieving car congestion by more nearly approximating actual travel is by improvements in routing. These are immediately necessary in view of the considerable increase in equipment which is required for adequate service and due to future growth. From this plan may be traced in code the recommended re-routing of every line outbound from the downtown district and the number of cars outbound on each street during the rush hour resulting therefrom. The principal changes from the present routing plans consist in using Mission Street for part of additional Haight and Hayes traffic, use of Howard Street for the San Mateo line, and the installation of loop terminals for short lines, excepting the stub terminals in the 100-Vara streets at Market Street which have become necessary because of the absence of terminal capacity at the Ferry. Market Street traffic has probably reached the limit and further traffic increase must be diverted.

unimpaired, and at the same time relieve Market of all traffic originating to the south.

Hayes line to be split either at Polk or Larkin Streets, 15 cars per hour running over the present route and 12 via Mission Street to a stub terminal in Fifth at Market Street. The object of diverting this traffic is the same as in the case of the Haight Street line.

Market-Castro, while satisfactory for the present, forms the most logical route after Haight and Hayes, to be partly diverted to Mission Street and this should be done eventually as the congestion on lower Market increases.

Valencia, being the only Market Street line running into the Mission district, can hardly be diverted justly at the present time. Ultimately it will be desirable to parallel this line, especially out 29th Street by a Mission line, in order to furnish direct service to the Valencia travel originating south of Market Street.

McAllister through service to the Ferry may be limited to 20 cars per hour by short running additional service from a stub terminal at Eddy and Powell, or by a Turk-Eddy collecting loop. Preferably, this service should be routed via Turk and Eddy Streets as far as Divisadero Street and thence out McAllister (new route).

Ellis-Richmond to be run down Ellis Street and across Fourth to the depot; every third car stub-ended at Market Street on the outbound (north) track. (See preceding discussion of capacity.)

Ellis (Fillmore)-Jackson (new route). Entire service to be stub-ended in Ellis at Market Street, outbound track, unless looped via Stockton, Post, and Taylor Streets.

Eddy-Hayes to use the present stub-terminal at Eddy and Market Streets.

Geary Street line to be run to the Ferry on the outer Market Street tracks. Part of the service to be short-run to Kearny Street, preferably by means of a Kearny-Post-Stockton Street collecting loop rather than stub-ended in Geary Street.

Sutter Street lines to be split at Market Street, part running to the Ferry over the outer Market Street tracks, and part short-running to Sansome Street, preferably by the Sansome-Bush-Montgomery Street loop, rather than stub-ended.

Post-(Polk)-Pacific (new route) to utilize Post Street to Kearny with terminal loop via Kearny, Washington and inbound on Montgomery Street. Two blocks of new track on Post Street are necessary for which some form of franchise will be required.

San Mateo is the only interurban line on the system and inasmuch as it should serve *long-haul traffic only,* there is no necessity

for it to terminate at Market Street, especially since all terminals in that vicinity are already congested. In accordance with the plan of providing loop terminals at the edge of the loading district for such lines, the San Mateo interurban should be looped via Fifth, Mission and Sixth and run out Howard Street as far as 26th Street. Ample service direct out Mission Street is available for short-haul traffic.

Mission (Daly City) to be routed from the stub terminal in Fifth at Market, to Howard, to 14th, and thence out Mission Street. This line is taken off of lower Mission Street in order to relieve congestion resulting from the necessary diversion of new Market Street service, and inasmuch as it is designed particularly for long-haul traffic, this should not be a hardship.

Mission (short line) comprising all short-run tripper service on Mission Street, to stub in Second at Market, and run to Onondaga Avenue, and later to the Visitacion line, as traffic develops. This route is primarily intended for short-haul riders during the rush period only.

Mission-24th to be routed to its present terminal during the day, but during the rush hour half of the service to be short run to the stub in First at Market Street, to avoid over-crowding at the Ferry terminal.

Sunnyside to be short-run via First, Folsom and Second Street loop. Serving the purpose of a short-run line paralleling the Guerrero Street line, it is unnecessary to run to the Ferry.

Tenth and Montgomery to utilize the Kearny-Washington-Montgomery loop.

First-Fifth appears to be superfluous and may be discontinued, as it does not run between logical terminals and serves practically no traffic. If, however, present operation is continued, the eastern terminals might be extended on split headway to (1) Kearny and Bush Streets; and (2) to California and Battery Streets, but should preferably be stub-ended south of Market Street.

Unchanged Routes. Ingleside, Cemeteries, Guerrero, Bryant, Folsom, Howard, Eighth and Eighteenth, Harrison, San Bruno, Sixth and Sansome, and Kearny Street.

Depot Terminal. No changes should be made in terminal arrangements at this point until the plans of the railway company for its new depot are disclosed. At that time, however, no cars should be allowed to stub-end in Third Street in front of the Depot, thereby obstructing the through traffic, but rather in Townsend Street east and west of Third Street.

California Street. Electric tracks have been laid for operation over the cable tracks from Kearny to Market Streets, but it is practically out of the question† to superimpose an additional route upon the Market Street traffic, already totaling 167 cars per hour with the four-track plan, until the elevated Ferry terminal is built. Although it might prove advantageous to operate either the Sutter short lines via Kearny and California as far as Market, or some route from south of Market crossing at Third, the greatest need for this California Street service is fulfilled by the Kearny-Montgomery terminal loop for west-bound travel and by extending Sutter Street service to the Ferry. As the actual headway of cable cars is now about 2¼ minutes the additional capacity for through electric cars is extremely limited unless turnout tracks can be built out into the Plaza to entirely clear the present cable stub terminal‡

REROUTING—OUTLYING DISTRICT

Several factors combine to make an ideal routing plan impossible in San Francisco:

1. Adherence to rectangular streets, irrespective of contours.
2. Numerous grades impossible for street railway operation.
3. Interposition of extensive unsettled areas such as parks and cemeteries.
4. Absence of diagonal thoroughfares along natural low-level routes.
5. Absence of parallel distributing thoroughfares north of Market Street.
6. Limited access to important outlying districts except through single narrow throats.
7. Necessity of adherence to old routing in order to hold existing franchises against possible competitors.

An ideal system of routing should provide direct service over radial trunk lines from the business center to each outlying settled district with cross-town lines at intervals, providing convenient communication between outlying residence sections having a community of interest. This ideal is, of course, impossible here, due to topographical and other difficulties above mentioned. But this plan can be approximated to a certain degree. Particular attention should be directed to the development of the direct low-grade routes now available as a means of extending the 30-minute time zone, which to a certain extent practically fixes the limits of dense settlement.

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†Assuming that Geary and Sutter Street service will be first extended to the Ferry. If not, then the California extension could be used.

‡Capacity of stub terminal with through operation superimposed is discussed on page 144 for conditions permitting no turnouts.

Short-run Trippers. To partially clear the streets of short-haul riders and avoid superimposing this class of traffic on long-haul cars, the use of short-run "trippers" is both desirable and necessary. Objection is often made to this form of operation, but it is the logical and proper way to *distribute service according to the traffic,* and to avoid much useless car mileage as well as overcrowding of cars. In order to pick up the short-haul traffic, these short-run trippers should precede the regular through cars. While this unquestionably disturbs the *regularity* of the headway, it is evidently not impracticable on trunk lines having frequent service.

Fast Limited Service. An effective way of separating long and short-haul loads and at the same time provide rapid transit is by the institution of limited-stop runs. Inasmuch as San Francisco has no streets which may be *exclusively* devoted to rapid transit cars, the best that can be done is to operate limited cars just ahead of locals, so as to give the fast line an opportunity of making time by gaining upon the next preceding local. In some cases passing tracks may be possible to enable the "limited" to clear local cars entirely. This class of service is particularly desirable on direct lines to the Ocean beach and down the Peninsula.

Topographic Obstructions. In the Western Addition district, the obstruction interposed by the cemeteries has limited the number of direct through routes into the Richmond district, and forced the use of so-called "Z" lines such as Sutter-Jackson, Turk-Eddy, and Hayes-Ellis. In some cases, as the Sutter-Jackson, the "Z" line is necessary to provide through service between the northwestern section and the business district; but wherever possible, a direct route should be adhered to as closely as topography permits, in the interests of rapid transit. The present Ellis-Ocean line, which carries patrons fully 0.6 miles further than necessary between the terminal district and the Park, is a typical example of the inherent defect in "Z" lines, and passengers now prefer to transfer to the direct Haight Street line at Stanyan Street rather than ride to the business district over an indirect route.

South of the Park, Buena Vista Heights prèvent direct communication with Market Street and leaving only a single entrance throat (Lincoln Way) from the north to the Sunset district, except by Park crossings or the Twin Peaks tunnel.

Similarly, the Mission throat at 30th Street provides the only exit to the south except the crooked San Bruno Road or the Kentucky-Railroad Avenue line along the eastern harbor front to Visitacion. San Jose Avenue furnishes an exit through the Mission throat, but requires the development of Bernal Cut and Circular Avenue to make it at all effective.

Harbor View can be conveniently reached only over the Van Ness saddle, and requires the Fillmore Street tunnel for direct communication from the south and the Broadway tunnel from the east.

The upper slopes of Eureka and Noe Valleys are in need of service, which is now difficult to provide due to impossible grades, but which may be had by the contour extension of Market Street.

City Plan. To partially remedy the difficulties arising from these unfortunate conditions certain improvements in the city plan are recommended in Chapter 12, of which the following are the most important as regards routing; these, however, have not been considered as part of the immediate rerouting scheme: (a) improvement of Bernal Cut and Circular Avenue; (b) Hayes Street cut; (c) Park crossings; (d) improvement of San Bruno Avenue; (e) Market Street contour extension; (f) Noe Valley tunnel.

Rerouting Plan

From a study of the riding characteristics of different routes as found by actual counts, and the relative volume of through riding and transfer loads, the following system is recommended for immediate adoption by the United Railroads. In working out these recommendations, certain minor alterations and additions to the present system have not been considered as standing in the way of the rerouting plans: (a) Pacific Avenue electrification; (b) double track on Post Street from Leavenworth to Larkin; (c) additional special work where necessary.

The principal changes made in the present plan of routing in the outlying districts are listed below, and should be studied in connection with the terminal routing previously discussed.

Hayes-Sunset to serve Ninth Avenue by the present route, and in addition to be extended out to 20th Avenue via Page and Oak, Stanyan and Lincoln Way. Every third car to run over the Parkside line, thus giving direct service into lower Sunset from the downtown district.

Haight-Ocean. Part of the service to be extended to the Beach by Stanyan and Lincoln Way. This method of serving the Sunset and Beach districts is much more effective than that of hauling passengers over the round-about Ellis-Ocean line, and will result not only in better service to those sections, but also to the districts directly tributary to the Hayes and Haight Street lines, where service will be considerably increased. These Sunset and Beach cars should all be routed on Mission Street, thus leaving a great part of the *short-run* Haight and Hayes service on Market Street as at the present.

Ellis-North Richmond. The Turk-Eddy and the Ellis-O'Farrell lines should unquestionably be interchanged in the interests of more direct routing and lower running time, since with proper cross-town service there appears to be no good reason why these two lines should intersect on Divisadero Street. This proposed line preserves the present Turk-Eddy service into north Richmond and in addition reaches the Southern Pacific Depot.

Eddy-Hayes. For the same reason, Turk and Eddy Streets should be used to serve more directly that portion of Hayes Street west of Divisadero (now served by the Hayes-Ellis line) until the Hayes Street Cut is completed.

Eddy-South Richmond designed to serve as a short-run route from Eddy and Market Streets to the present Richmond loop via Turk and Eddy, Divisadero, McAllister and Fulton to Eighth Avenue, thus paralleling McAllister Street and furnishing any additional or tripper service necessary thereon. This line will provide a much more direct route to the business center than now available for a large part of the east Richmond district, and on Sundays or holidays could be easily extended out Fulton Street to the Beach and in to the Ferry as a *fast limited* line, making two stops only between Market and Divisadero Streets, *viz.*: Larkin and Fillmore Streets. The use of single-tracked streets for the fast service is obviously reasonable on account of decreased vehicle obstruction.

Ellis (Fillmore)-Jackson designed to replace the present Sutter-Jackson line, which will be impossible to operate at the Fillmore tunnel entrance. North of Sutter Street, the route will be same as at present excepting that it will terminate at Jackson and Presidio Avenue, instead of California and Presidio.

Sutter short line service (now furnished by the Sutter-Jackson line) to be furnished by one operating the length of Sutter Street, branching off at Presidio Ave. and California St., thence running north to Jackson Street. This will complete the service now furnished by Sutter-Jackson.

Post-(Polk)-Pacific (new route). This new line, although requiring two blocks of new track on Post, from Leavenworth to Larkin Streets, and necessitating electrification of the Pacific Avenue line, is one of the most logical improvements of the entire system. Its need is obvious, providing direct downtown service to the large population on Pacific Heights, now served by extremely inadequate means. It should preferably use the Kearny-Washington-Montgomery collecting loop, rather than a stub terminal in Post Street. Possibly a connecting route out Jackson Street through Fillmore Street will become advantageous as this route develops.

Mission-Richmond to be extended out Clement to 13th Avenue, instead of running south to the Park as at present, so as to avoid doubling back; on the southern end, the function of a cross-town line is preserved by routing via 22d, Howard, and 24th to Utah Street. This line will continue to furnish a direct connection between Richmond and the Mission business districts, and at the same time provide cross-town service which will enable Richmond residents to reach any part of the Mission district with a single transfer, instead of two, as are now necessary.

Market-Castro to be extended out 18th to Eureka or Douglass Streets in order to directly serve the traffic originating in Eureka Valley.

Bryant-(Cortland) to be extended from 26th and Bryant to Cortland and Banks via Mission Street and Cortland Avenue. Traffic counts indicate clearly the necessity of extending this route, and it will provide direct downtown service to the Bernal Heights district, now served only by a cross-town connection.

Mission Short-Run to be routed out Mission Street as far as Onondaga during rush hours only to relieve all long-haul cars using Mission Street.

San Mateo Interurban to run on Howard instead of Mission as far as 26th Street, so as to avoid the congested districts, and operated with *limited stops* as far as the County line, so as to avoid short-haul traffic.

Mission-Sixteenth (new line) to furnish rush hour tripper service only from Sixteenth and Bryant to Richland Avenue, via Bryant and Mission. This line will relieve the Fillmore-Sixteenth and Bryant Street lines of the excessive transfer load now encountered at Sixteenth and Bryant, as well as accommodate Mission Street short-haul. It should be extended to Kentucky Street along Sixteenth, Seventeenth, and Eighteenth, or else:

Fillmore-Sixteenth should run more cars to the same terminal.

Valencia-Gough to be extended west on Sacramento to Presidio Avenue and stub-ended at Presidio and California, which is a more logical and convenient terminal, owing to its importance as a transfer point.

SERVICE REDISTRIBUTION

In the assignment of service, the essential points to be considered are:

First. Does the car loading indicate the need of additional service as determined by (a) results of throat counts; (b) extent of standing load; (c) seasonal variation; (d) standards of car loading?

Second. Do the earnings justify an increase in car mileage as shown by (e) earnings and passengers per car mile; and (f) average passenger haul?

Third. How may the service be increased with the minimum increase in operating expense—dependent upon (g) increased speed *vs.* more cars; (h) suggested improvements in city plan; (i) extensions and short-haul trippers; (j) car barn location and dead mileage?

Determination of Increase in Service. In general, there are two criterions of service:

1. Reasonable headway on light lines;
2. Relative loading on heavy lines.

If a light line is to operate at all, it must maintain a reasonable headway—that is, 5 to 10 minutes, depending upon the locality—whether or not the traffic is sufficient to fill all seats. On the other hand, the headway on heavy lines is entirely a function of the traffic and the permissible car loading. It is therefore manifestly improper to base the increase in service upon the *average* car loading for the entire system, but must be determined for each route separately. Thus, while the average capacity of individual electric cars is 175% of the seats, the average loading on the entire system for the heaviest 15-minute period of the day was only about 183% indicating that but little additional service is required—obviously an erroneous conclusion, for the routes carrying an excess over the comfortable capacity show average loading of 224% and on some lines as high as 271% of seating capacity.†

Therefore, of the several methods to be applied, it appears that the most accurate is to determine from throat counts during each 15-minute period of the rush hour how many additional trips are required on each route to bring the loading down to the comfortable standard. Moreover, whenever any line carries so much long-haul traffic that passengers are required to stand for excessive periods, additional service should be provided, even though the throat loading is below the comfortable standard specified herein.

The loading standards fixed in Chapter 5 are based upon the total amount of standing space available in the car when loaded uniformly, but owing to unavoidable variation in loading due to sluggish passenger movement, the real capacity of the car is proportionately reduced. On this account, an extra margin of 10% has been allowed for prepay equipment only when applied to an average rush period rather than to individual cars.

On the above basis, it then appears that under traffic conditions of July, 1912, 65 additional outbound trips, distributed as shown in

†For detailed results of traffic counts, see Table 25.

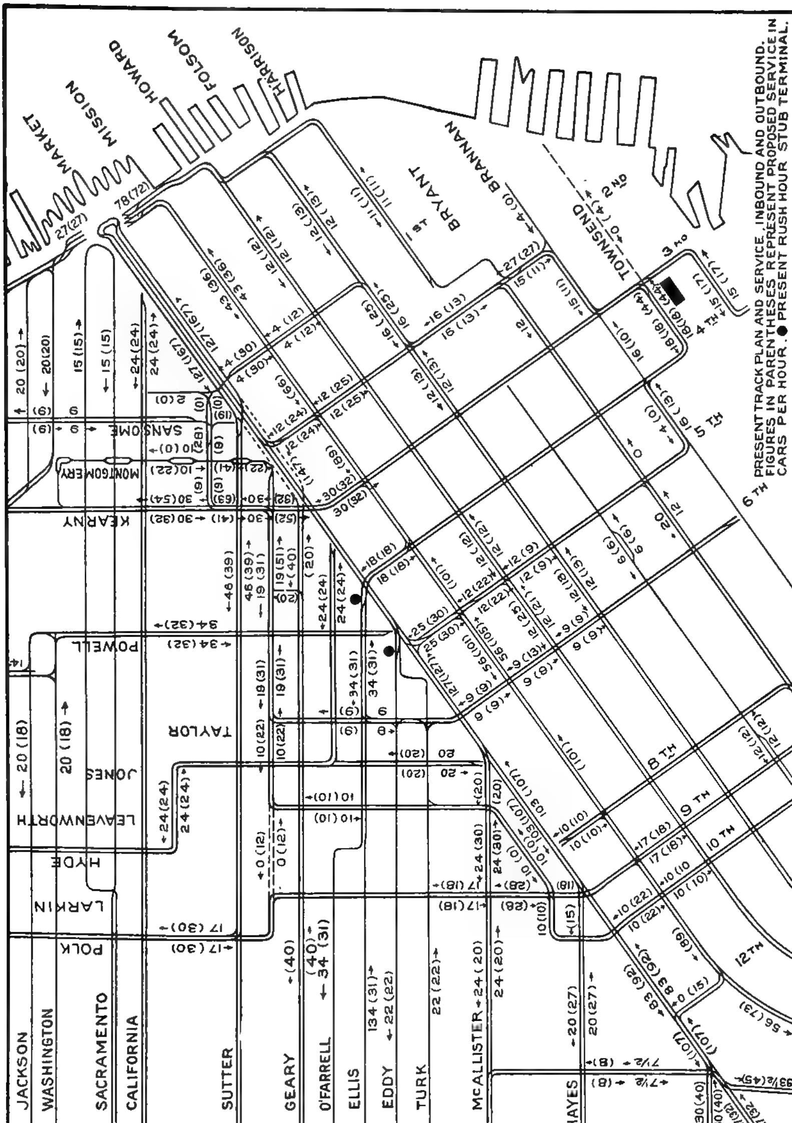

FIGURE 38—DOWNTOWN TRACKAGE AND RUSH HOUR CAR SERVICE.

Plan of present trackage showing the car service now operated in cars per hour, and the direction of car movement on each street. The redistribution of service as developed from traffic counts is shown in parentheses. The changes include principally increased use of Mission Street and of the stub terminals south of Market, and the more even usage of the Western Addition streets. By diverting practically all of the necessary increase to Mission, Market Street service is practically limited to the present amount.

Table 27, were needed from the terminal district during the rush hour. Using the present routing, this added service will call for an *increase* of about 740 car miles, or 14.4% of the total rush hour mileage of the system.

If the service over *present routes* is more effectively distributed by the operation of short-run cars to logical turn-back points, as recommended herein, the total saving during the rush hour (amounting to 267 car miles or 5.2%) reduces the net increase required over the present to 9.2% of the total rush hour mileage.

Applying the same number of rush hour outbound trips, distributed in the most logical manner to a *system rerouted* as recommended herein, detailed in Table 26, the total saving in rush hour mileage (355 car miles or 6% below that necessary for *adequate service on the present system*) reduces the net increase to 7.5% over the present. That is, approximately *one-half the increase in service necessary is saved by the rerouting plans.*

Present Requirements. Inasmuch as the traffic has been increasing ½% per month, the above estimates are, for present traffic, probably too low, by 3½% or 19 trips, making a total necessary increase of 84 trips. And it will thus be evident that in order that the service may keep pace with requirements of travel, the Company should continue passenger counts at the various throats, to intelligently apportion the service from time to time.

Finally, it appears that under present routing, while the additional rolling stock now on order would have sufficed for increased service in July, 1912, about 84 additional cars are now needed as nearly as can be estimated without further traffic counts; and the records of passenger traffic indicate that at least 3 new cars per month are now required, the rate increasing as time goes on.

One opportunity of reducing this demand for additional equipment is open to the Company—*i. e.*, by an increase of schedule speed through the various means suggested herein. Since 1908 this speed has been gradually raised to 8.5 miles per hour, or about 12% increase.

Midday Service. Owing to the large extra investment necessary for short rush periods, the standards of loading as fixed are necessarily high, and are not applicable to midday operation, when the travel is fairly constant. On most lines the standard of a *seat for every passenger* should prevail except that for short noon peaks some standing will be unavoidable. Midday service on light lines must necessarily be fixed by a reasonable headway irrespective of the traffic carried. (See reference to headway, page 154.)†

†Plate 6 shows present rush and day headway.

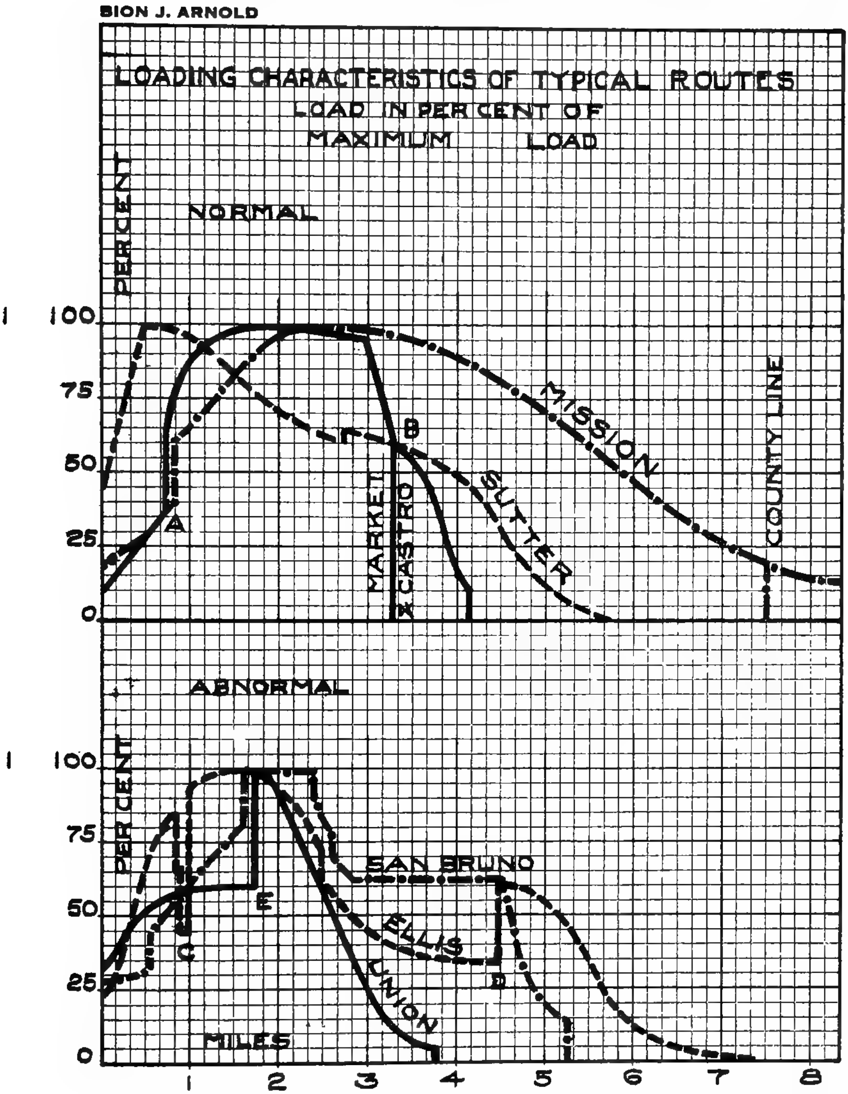

FIGURE 39.—LOADING CHARACTERISTICS OF TYPICAL ROUTES.

Indicating the great variety of conditions to be met in serving long and short-haul lines and those having heavy transfer traffic. "A" shows the heavy loading of south-bound trunk lines at Third and Kearny Streets. At "B" practically the entire Market Street load transfers to the Castro Street cable. At "C" half of the load transfers to and from Market Street. "E" shows the importance of cross-town transfers to the Union Street line. "D" indicates the heavy transfer load to Ellis-Ocean from the Haight Street terminus at Stanyan Street. Observe that Sutter Street cars reach their maximum load within one-half mile of Market Street—*i. e.,* east of Stockton Street.

During the periods of light travel, day and night, the schedule *speed should be increased* to the maximum to compensate for the shorter and fewer stops, thus effecting a saving in operation. And with long headways, prompt dispatching of cars is necessary so as to minimize variations in headway. Also, schedules should be carefully arranged for the maximum accommodation of passengers at transfer points.

Owl Service. This is an indispensable part of the system which, although mostly unprofitable, must be maintained as a public accommodation. A maximum headway of 30 minutes on important lines and 60 minutes on the less important probably represents the reasonable limits of convenience. The service lines at present operated require one extension—from Haight and Stanyan to 20th Avenue via Stanyan and Lincoln Way.

ROUTING FOR MUNICIPAL SYSTEM

Development *vs.* Competition

As presented in Chapter 3, the program of track extensions recommended for a unified system of operation (irrespective of ownership) may be segregated into—(a) lines which may form part of a municipal system; (b) lines which most logically form part of the existing private system; and (c) additional extensions to both municipal and private systems which might be warranted in case direct competition should prove unavoidable. These would necessarily involve considerable duplication in service and investment.

In Table 10, "Extensions to Unified System," there are indicated certain lines which should be built first, and others to follow thereafter, all of which may be regarded as practically non-competitive or development lines under the assumption that the Municipal Railway is to be extended largely into unserved territory, *i. e.,* to develop new territory. In a strict sense, every municipal line will be competitive in that it subtracts from the possibilities of the present private system. This is particularly so in the Geary Street line itself. However, if the Municipal system is expanded with the primary object of developing the city, rather than absorbing as much of existing traffic as possible, such a policy would become more justifiable.

Routing—Development Lines. Upon this basis, certain routes may be defined, based upon the extensions listed in the following table, which appear to be warranted at the present time, as traversing territory sufficiently settled to enable the system as a whole to practically pay from the start. Unless at least a part of the tunnel program is carried out, Geary Street must remain the

principal trunk line or *entrance* thoroughfare into the business district. And on account of these limited entrance facilities, cross-town lines with transfers must be depended upon to an unusual degree, in order to avoid overloading Geary Street with an excessive number of routes.

MUNICIPAL RAILWAY ROUTES.*

Largely Development, *i. e.,* Non-competitive

NO TUNNELS EXCEPT STOCKTON STREET

1. *Ocean*—GEARY, Thirty-third, Balboa, Forty-fifth, Cabrillo to Beach. Short-run to Thirty-third Avenue.†
2. *Sunset*—GEARY, Tenth, Park crossing, Judah to Twentieth. Serves as Geary Street short-run to Tenth Avenue.
3. *Cliff*—GEARY, Arguello, California, Thirty-third to Cliff. Short-run to Thirteenth Avenue.
4. *Laurel Hill Loop*—GEARY, Presidio, Washington, Arguello, Geary. Downtown loop—Kearny, Post, Stockton or Grant Avenue.
5. *Presidio*—GEARY, Van Ness, Union, Steiner, Greenwich, Baker to waterfront; short-run to Baker. (To Presidio loop during Exposition.)
6. *Masonic* (Cross-town)—Cole, Waller, MASONIC, Geary, Presidio to Pacific (possibly out Washington to Arguello Boulevard.) Alternative—split via Frederick, and Hugo to Seventh.
7. *Van Ness* (Cross-town)—From Harbor View via VAN NESS, Eleventh (or Twelfth if Van Ness is extended) to Potrero Avenue. (Extend down Potrero to Army Street during Exposition).
8. *Stockton Tunnel*—STOCKTON, Columbus, North Point, Van Ness, Exposition; extend south via Fourth, Bryant, Third to Depot.
9. *Potrero*—From Market via Seventh, Brannan, POTRERO, to Army Street. Split with Potrero Hill line. (Extend later to University Mound via San Bruno Road or Ocean Shore tracks, Silver Avenue and Cambridge Street).
10. *Potrero Hill*—From Market via SEVENTH, Brannan, Eighth, Sixteenth, Connecticut, Twentieth, Arkansas (regrade). Split with Potrero Avenue.
11. *Union Street*—As at present. During Exposition additional route from Ferry via Columbus, North Point, Van Ness, Exposition.

WITH TUNNELS—STOCKTON, BROADWAY, FILLMORE, TWIN PEAKS

13. *Stockton-Chestnut*—From Depot via Third, Bryant, Fourth, Stockton tunnel, Broadway tunnel, Van Ness, CHESTNUT to Divisadero. Split to Exposition loop.
14. *Union Street* (Low Level)—From Ferries via Washington and Jackson, Columbus, Broadway tunnel, UNION, Steiner, Greenwich to Baker Street. Split to Presidio and waterfront. (Substitute for Presidio line via Geary Street.)
15. *Fillmore*—From Ferries via Market, Geary, FILLMORE tunnel, Chestnut Street. During Exposition, use Main and Presidio loops.
16. *Fillmore-Church* (Cross-town)—From Chestnut via FILLMORE, Geary, Laguna, Guerrero, Sixteenth, CHURCH, Chattanooga tunnel to Thirtieth Street. Split on Twentieth to Potrero Avenue.
17. *Masonic-Fillmore* (Cross-town)—Split MASONIC cross-town at Geary and Presidio via Geary and FILLMORE tunnel to Chestnut Street.

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*Trunk lines in capitals.

†Short-run routes are designed for short-haul traffic only and the cars switch back after this short-haul load has been distributed.

18. *Twin Peaks tunnel* lines entirely dependent upon entrance possibilities into Market and Mission Streets. Transit center in Block No. 12 (bounded by Market, Mission, Eleventh and Twelfth), with unusual transfer facilities, appears favorable for distributing to all points of the city.

Municipal Competitive System. Assuming that a competitive system must be developed, Fig. 10 indicates the possibilities of such development by various construction stages. It will be noted that a large amount of existing track of the United Railroads has been commissioned for Municipal use under the State five-block law, which authorizes joint operation (and maintenance) between two independent companies. This joint trackage amounts to as much as 15 miles out of a total for the system of about 110 miles (of single track), of which about 80 miles is yet to be built. A total investment of at least $6,500,000 is involved (including a probable equipment of over 300 cars), exclusive of reconstruction of existing lines upon which franchises have already expired.

In spite of the comprehensive nature of this Municipal plan, many districts of the city cannot be served by it without unwarranted investment, and even then the results would in many cases be unsatisfactory, due to circuitous routing. While the Geary Street trunk line is well suited to the development of Richmond, it is extremely difficult to obtain adequate downtown terminal facilities for Municipal lines projected into the Mission, and all the possible Mission routes must therefore be considered as *inferior* to existing routes in directness and desirability. However, the best stub and loop terminals now available under these limitations and those of the five-block law have been selected.

On the other hand, for service in a northerly direction to the Exposition, the Municipal routes are well located for direct routing from the Mission. And the Union Street line, with its recommended extensions, undoubtedly gives to the City a great advantage in the matter of service lines from the Ferry to the Exposition. But it must not be lost sight of that although these routes and lines may be desirable *per se,* the absence of universal transfers necessarily discourages the freest use of such routes, especially when operated in competition with existing routes whose patrons enjoy universal transfer privileges. Therefore, the practicability of many of these lines depends largely upon what transfer facilities can be secured.

This is particularly true in the case of Municipal lines to be operated through the Twin Peaks tunnel. Whether the Market Street subway section be built, or, in lieu thereof, two additional tracks be run on Market Street from Castro Street to Van Ness Avenue (assuming this right can be obtained) Municipal lines could not even then reach the downtown district except in a circuitous manner, un-

less the tunnel lines were extended over an elevated structure in Minna Street, as indicated in Fig. 19. Obviously, therefore, the success of the Twin Peaks project for suburban service depends largely upon the securing of through routing or transfer privileges with existing lines. In the latter case, the establishment of a transit center in Block 12 (Market, Eleventh, Mission, Twelfth) would become a distinct convenience.

Rental Basis. These conditions suggest the desirability of working out a rental plan by which the City would retain ownership and yet secure the advantages of operation as part of the larger unified system. Such a plan would immediately make possible many of these extensions now impossible, yet needed, and especially would enable the entire city to benefit by maximum service to the Exposition on the most direct routes, while retaining in the City's hands the indisputable control of the transit lines in that locality.

Or, in lieu of rental, it is quite possible that an interchange of car service or of operating rights could be developed so as to provide maximum convenience to patrons of both Municipal and private lines. This would be in the nature of "through route" operation between independent companies, as is now in force throughout Chicago, and only requires mutual agreement between joint operators respecting equipment, schedules, power, maintenance, and exchange of transfers.

Parts of this general extension plan such as Church Street and Army Street, are clearly desirable, and yet are seriously handicapped if not rendered impracticable by lack of unification and transfers with existing lines. Others are so clearly a duplication of investment for the purpose of competition as to be unwarranted except under extreme conditions, viz., the Capp-Shotwell loop into the Mission.

In conclusion, the only logical course for the City to pursue, in my judgment, *unless all hope of co-operation with existing companies must be abandoned,* is to install such Municipal routes as are clearly of immediate necessity for properly serving the districts covered and to secure as far as possible through route operation by rentals or exchange of operating rights. Until the Municipal system establishes itself, without question, as a stable, paying investment (with proper allowances for maintenance, depreciation and renewals, amortization and lost taxes) it would seem unwise for the City to risk its credit in an extensive campaign of competition under the distinct handicap of higher operating costs and limited transfer facilities. For it clearly must depend upon its credit to make possible the large bond issues necessary for future railway construction.

MUNICIPAL ROUTES—COMPETITIVE

1. *Mission Loop* —From Army via Capp and Shotwell, Howard, Twelfth, Van Ness, GEARY. During Exposition extend via Van Ness to Exposition loop. Alternative—via Howard, Ninth, Larkin, Turk and Eddy loop.
2. *Church Street*—From Mission via Thirtieth, Church, Chattanooga tunnel, Market (four-tracks), Van Ness, GEARY.
3. *Army* (Cross-town) —From Kentucky via ARMY, Church, Twenty-sixth, to Castro. (The line really non-competitive, but dependent upon transfer from competitive lines.)
4. *Masonic Loop*—From Masonic Avenue via Hayes, Divisadero, OAK, Van Ness, McAllister, Larkin, Turk-Eddy loop.
5. *Scott-Twentieth* (Cross-town) —From Geary Street via Pierce, Fulton, SCOTT, Duboce, Noe, Sixteenth, Church, TWENTIETH to Potrero Avenue.
6. *Buena Vista* —From Buena Vista Heights via Park Hill, Fourteenth, Castro, Duboce, Scott to OAK Street. Split with Masonic loop line.
7. *Laguna-San Jose* (Cross-town)—From Geary via LAGUNA, Guerrero, Seventeenth, Valencia, SAN JOSE, to Bernal Cut.

DOWNTOWN TERMINALS (ALTERNATIVE)

SOUTH OF MARKET STREET LINES

(1) SEVENTH Street lines stub at Market Street, or

(2) SEVENTH Street lines loop via Folsom, Second, Mission and Seventh Streets.

(3) FIFTH Street lines loop via Folsom, Second, Mission and Fifth Streets. (Alternative entrance to Potrero lines.)

NORTH OF MARKET STREET LINES

(4) GEARY, Kearny, Post, Stockton (or Grant Avenue and Geary Street).

(5) LARKIN, Turk, Mason, Eddy and Larkin Streets.

Location of Outer Terminus of Geary Street Road

Originally the intent of the Geary Street bond issue was to continue the operation of Geary Street cars over the present tracks on Point Lobos Avenue, thence from the present terminal at 33d Avenue over the tracks of the United Railroads on the Clement Street line as far as Cliff Avenue; thence to construct new tracks along Cliff Avenue to 48th Avenue, thence around Sutro Heights to the Beach, returning by the same route. But before building over this route the following points should be determined:

1. Can the right to run over the tracks of the United Railroads for more than five blocks be acquired? (If not, this probably can be done by acquiring property rights between 38th and 39th Avenues, in order to accomplish the extension of Cliff Avenue to conform to the five-block joint operation law).

2. Can the standard rolling stock operate with safety on the steep grades and curves of the road to the beach as originally contemplated?

3. Will this route secure in the best manner the development of west Richmond?

4. Is it desirable from an economic standpoint to superimpose two competitive routes serving practically the same outlying territory?

Available Streets. A study of the grade map of Richmond shows *only two* available outlets to the beach—Point Lobos Avenue and Cabrillo Street—and that on the former, west of 47th Avenue, there is about 3,200 feet of *continuous* grade of 8% to 9.2%. Balboa Street, west of 33d Avenue as far as 47th Avenue is suitable for a car line, but only two descents from Point Lobos to Balboa Street are available—34th Avenue and 38th Avenue. Between Balboa and Cabrillo Sreets, only three low-grade passes exist west of 33d Avenue—45th Avenue (regraded to 5.6%), 41st Avenue (6.7%), and 37th Avenue (5.8%).

Thus the only method of reaching the beach and avoiding the long and dangerous grade around the Cliff is the gradual descent from Geary to Cabrillo Street, laid out to follow the contours. Although the Cliff House grade is not impossible, it is certainly not advisable with standard equipment, if it can be avoided.

Important Connections. The development of Lincoln Park will probably make it desirable for the Geary Street road to reach the main Park entrance which will be at either 33d or 34th Avenue. This can readily be accomplished by joint operation over the present lines of the Clement Street route in 33d Avenue, and thence to any desired point.

Sutro Heights, Sutro Baths, and the Cliff House are at present served by two existing routes leading from the business district by fairly direct lines.

In Golden Gate Park, the entrance near Spreckels Lake in 37th Avenue offers a direct path to the Stadium, and connects by a logical Park crossing with the Sunset District by a cross-town route already planned on 33d Avenue, as far as Sloat Boulevard.

The ocean front is now served by two existing routes, whose carrying capacity is taxed to the utmost on Sundays and holidays.

Development. Owing to the fact that Balboa Street is intermediate between Geary and Fulton, and two blocks distant from each, it is reasonable that this street requires and will be most responsive to additional transportation throughout its length. But as it is impossible to descend to the beach without very extensive regrading, the following routing appears to best meet present requirements: on Geary Street to 33d or 34th, to Balboa, to 45th, to Cabrillo, to the beach; return by the same route.

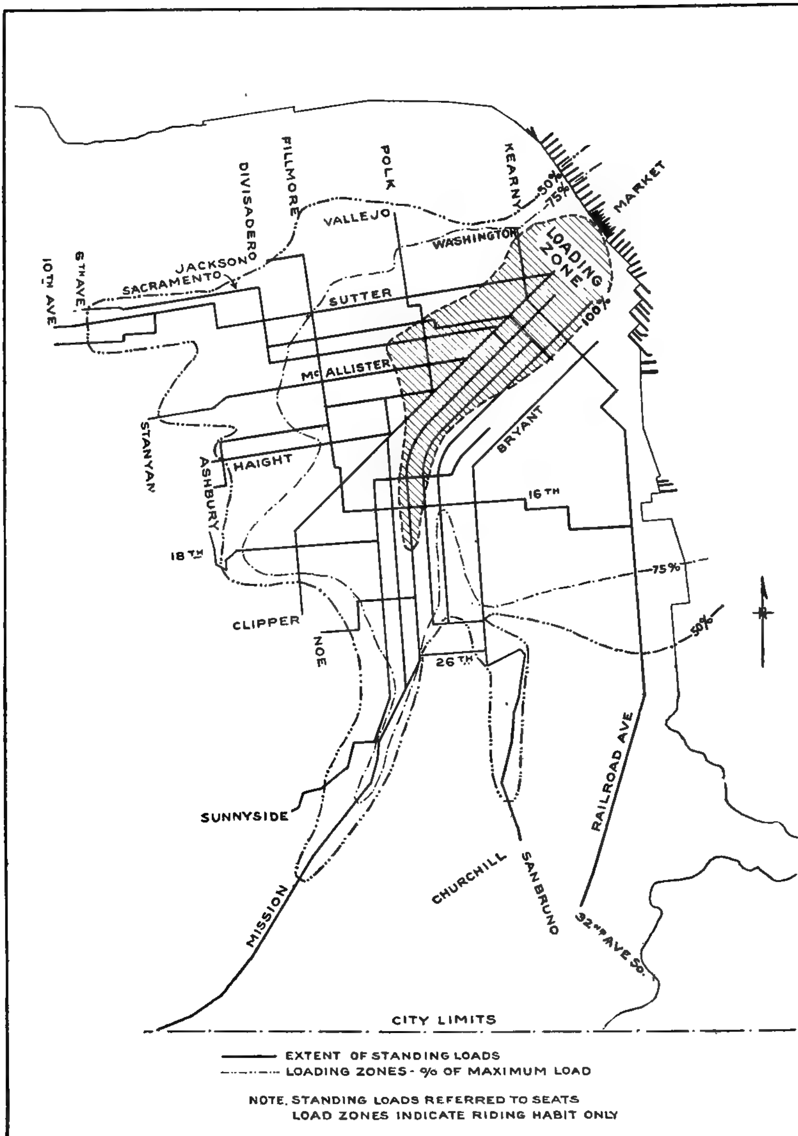

FIGURE 40—LOADING ZONES AND EXTENT OF STANDING LOAD.

The general character of rush hour travel within the city may be best indicated by zones of car loading at various points along the route, (expressed in per cent of the maximum load on the car.) Thus the 100% zone or loading district, shown by the cross-hatched area, extends far down into the Mission, and the half-load zone correspondingly further. That portion of the system shown in black lines indicates the extent of the average standing load, which represents the portion which should be covered by short-run routes. The long standing load through the Mission and South San Francisco districts as compared with the Western Addition travel is apparent, and it is this traffic which should be relieved in the redistribution of service contemplated.

An alternative, designed to cover the largest amount of undeveloped territory in west Richmond consists in separating the Geary Street extension into two single-track lines as follows, these to be laid on one side of the center line, so as to be in proper position for future double-tracking when desirable: Geary Street to 33d or 34th, to Anza, to 39th, to Balboa, to 45th, to Cabrillo, to beach; returning, Cabrillo to 37th, to Balboa, to 33rd or 34th, to Geary. This separation of tracks would inclose 13 blocks, but would inconvenience somewhat passengers residing on the higher levels.

Recommendation. The former plan is recommended for the present extension of the Geary Street road and coupled therewith the ultimate intention of extending the Balboa Street line eastwardly into Turk Street, which is very desirable to preserve; for this is the only remaining direct thoroughfare from the business district to the beach, unoccupied by car lines and which does not present impossible physical disadvantages in the way of regrades. The 34th Avenue section (or 33d regraded) in Sunset should be extended to Golden Gate Park, via 37th and a connection made with Lincoln Park as above indicated.

GENERAL DISCUSSION OF TRAFFIC AND SERVICE IMPROVEMENTS

As a means of determining actual riding characteristics, typical trip counts were made on each line during the rush hour, which in general indicate: (1) standards of service; (2) desirable limit for effective short-run routes; and (3) necessity for extension of the line—generally indicated by abrupt loading or unloading at the beginning or end of a route. (Observed data, Table 25.)

Passenger Flow. These results in composite form indicate the actual passenger flow in various streets during the rush hour, as shown in Plate 9. It is evident that for most efficient operation, service should be *proportioned* to the traffic as near as possible so long as a reasonably short headway is provided. In rerouting it has been the aim to "taper off" the service by the provision of short-haul runs and rush hour trippers, so as to conform to the actual variations in traffic shown. In this regard the problem is analogous to a system of tapered water mains.

Standing Load. Within the loading district, outbound cars were usually filled beyond their seating capacity before reaching Third or Kearny Streets, and this standing load continued into the Richmond, Sunset and Western Addition districts for 20 to 25 minutes, and as much as 40 minutes into some parts of the Mission, representing about a 6-mile haul. This condition is clearly shown in

the load zones (Fig. 40). The great extent of this standing load indicates in a general way the necessity for relief by short-haul trippers within these same limits.

Average Ride. Although the riding habit in San Francisco is very high, the average length of car haul—4.55 miles—is low as compared, for example, with Pittsburgh 5.13 miles, and Chicago 5.78 miles. Further, the average *passenger ride* here is also shorter—1.68 miles for the entire system; or reduced to a basis of cash passengers only, this corresponds to an average passenger *haul* of 2.4 miles for a single fare. Short car haul may be an indication of profitable operation—although not necessarily so—but the combination of high riding habit and short average passenger haul, without question, justifies a high standard of service. (See Table 28.)

Variation in Traffic. To provide uniform service throughout the year the conditions of travel with reference to the increase in service necessary to meet seasonal variation, as well as normal growth, require continuous study. That this seasonal variation in San Francisco is relatively small is indicated by the typical records (Fig. 43), and this fact relieves the Company from a large amount of investment in extra equipment idle much of the time.

Route Earnings. An accurate impression of the relative importance of the various lines from a standpoint of traffic and earnings may be obtained from Fig. 41, expressed both in totals and per car mile. Thus, the total earnings of the six heaviest lines —Haight, Valencia, McAllister, Ellis-Ocean, Turk-Eddy and Market Street—are about 2½ times the average for the system. For uniformity, all car-mile ratios have been calculated on the basis of an *average car* of 44 seats, irrespective of the actual type operated, on the assumption that for a given number of seats per hour operated, the same riding would occur regardless of the size of the car.

Against actual earnings of about 36 cents per car mile for the entire system, the first three routes mentioned above earn about 50 cents per car mile, and the Market, Kearny and Powell lines about 60 cents. On the other hand, 25 routes earn less than the average and ten, including the Parkside, Mail Dock and Pacific Avenue lines, do not pay average operating expenses. One route—Bosworth—carries passengers free. This diagram clearly emphasizes the fact that a railway system necessarily consists of a number of high earning lines, and many that do not pay fixed charges or in some cases even operating expenses.

The ratio, *total passengers per car mile*, is a relative index either of car loading or shortness of ride. Thus, the cross-town and transfer lines show extremely high traffic per car mile, due in gen-

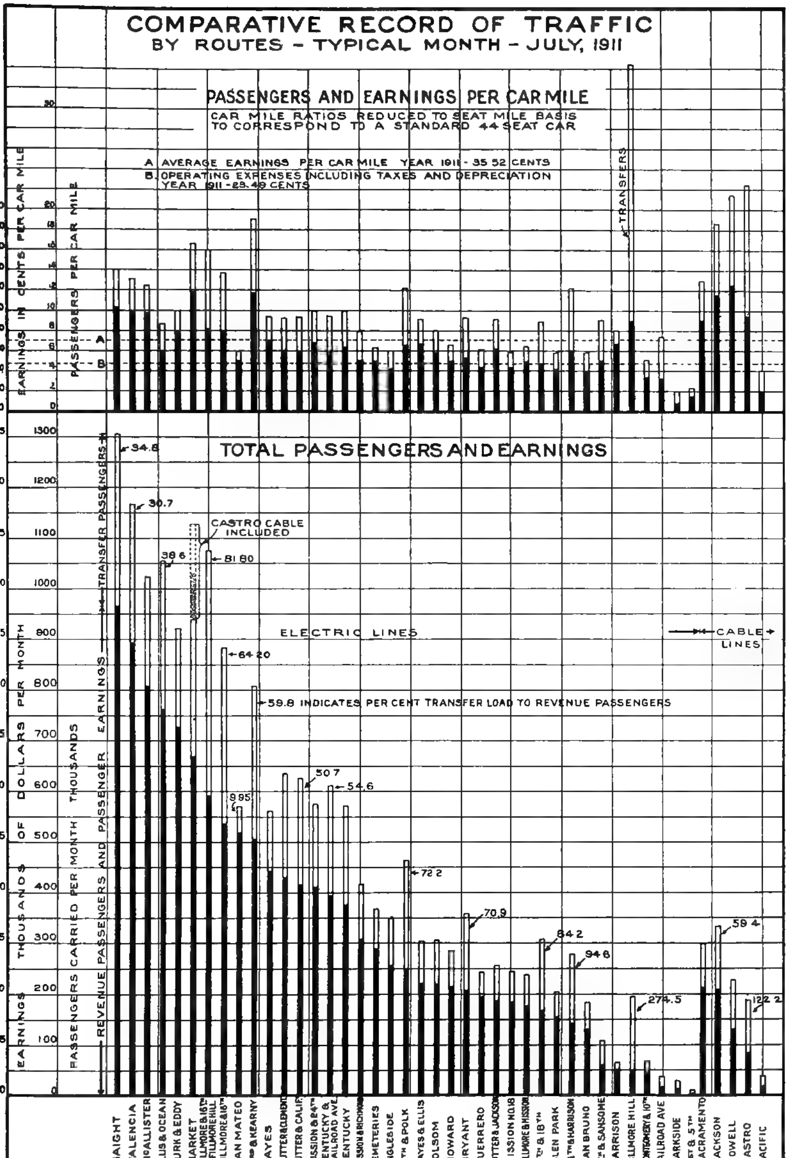

FIGURE 41—COMPARATIVE RECORD OF TRAFFIC BY ROUTES.

Relative importance of the various routes shown by the height of the solid lines, transfer business being indicated by the open lines. The wide variation in the earning capacity of the routes is apparent, indicating that a system is necessarily made up of a few very profitable lines, many of average earning capacity, and some that do not pay operating expenses.

Car mile ratios have been reduced to a common basis, assuming a standard 44-seat car. The earnings are generally speaking, high, as compared with other cities. Eight routes earn about 50 cents per standard car mile.

eral to short haul, while on the Bryant Street line it is due to limited service.

The effectiveness of cross-town lines such as Fillmore, Kearny and Polk, is shown by the large proportion of transfer traffic, rang- from 61% to 95% of the revenue traffic, as against an average of 43% for the entire system. The fact that the Kearny Street line, in addition to the high transfer traffic, carries more cash passengers per car mile than any other electric line, is evidence both of heavy traffic and short haul.

Operating Methods

Transfer System. The transfer policy of the United Railroads in some respects is entirely too liberal, although the intent is to allow transfers between intersecting lines at all points where round trip or *loop riding will not result.* How completely the city is covered and the minimum number of transfers necessary to reach any destination from an originating line are shown in the transfer charts, Fig. 42. Transfers are punched to show only the time limit and the direction the car is moving, the *destination line not being indicated,* so that any transfer is good within its time limit at any proper intersection. However, with the excess time almost invariably allowed, the use of a transfer as a *stop-over* becomes an easy matter. Passengers may transfer on a transfer by using cross-town lines (Polk, Fillmore, Kearny) which *validate* all transfers without lifting them, or else they are entitled to a second transfer only restricted to terminal lines. On the two downtown cross lines—*i. e.*, Kearny and Polk Streets—there is no limitation as to direction on the transfers. A study of this transfer system reveals the following discrepancies and desirable changes:

1. The lists of transfer points printed on the slips, which is the only information available to the public, are incomplete.

2. The opportunity for error on the part of the conductor is increased by the similarity in appearance of all transfers. The various routes should preferably be identified by distinctive colors.

3. No complete record of transfers is kept, so as to cover cross-town lines. All transfers collected or validated should be recorded either by exchanging transfers or by using a form of split transfer having a detachable slip.

4. Routes operated on the same street do not provide uniform transfer privileges.

5. Round trip riding is not eliminated and could justly be reduced by limiting the sequence of issuing transfers in certain cases. Some of the round trip rides now possible are: (a) from Stanyan and Haight—east on Haight, south on Fillmore, *stop-over,* west on 18th to end of line, one block from starting point. (b)

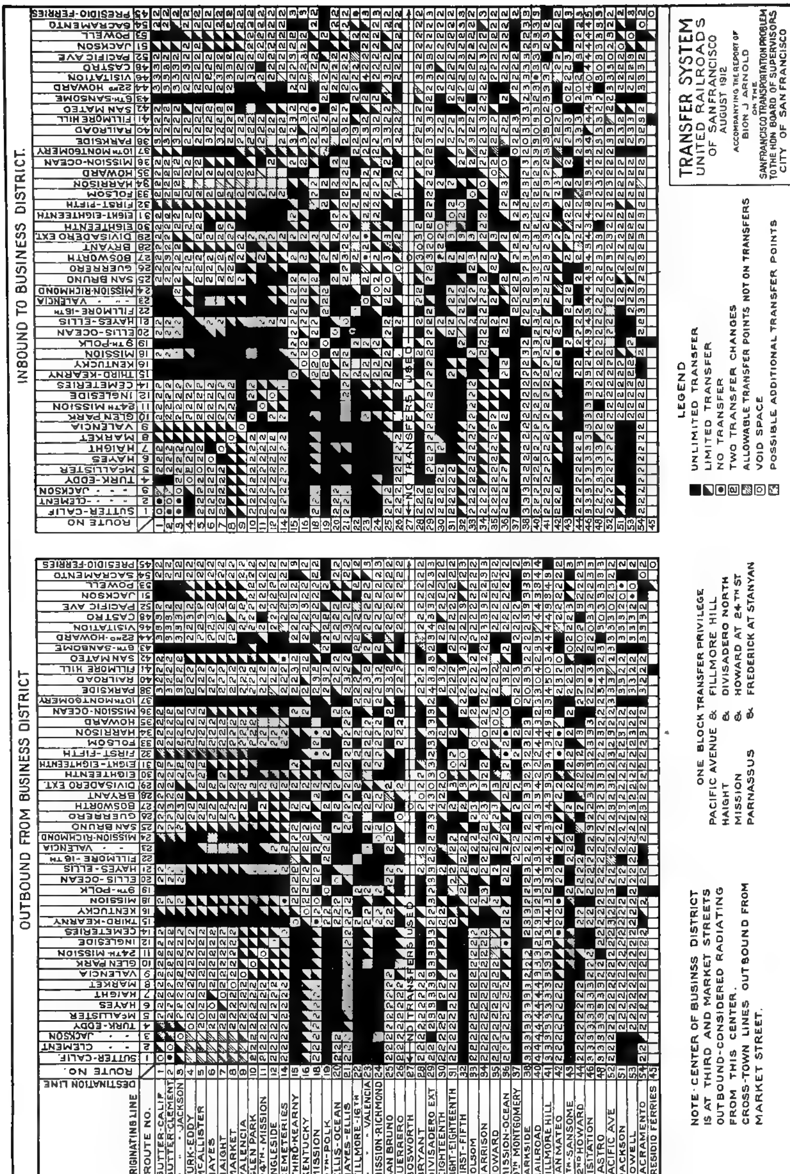

FIGURE 42—GRAPHICAL RECORD OF TRANSFER STATUS.

This answers the question whether transfer facilities in San Francisco are liberal or otherwise by indicating the transfers granted from any line in the city to any other line, and the number of transfers necessary if a direct transfer is impossible. Black spaces indicate unlimited transfer in both directions; black triangles, limited transfer in one direction only. There are comparatively few dots indicating points where no transfers are given. Some additional transfers are now allowed as shown by the cross-hatched squares, in addition to the transfers shown in black, which represent those actually printed on the transfer slips, and there are comparatively few points indicated by the dotted areas where further transfers should be given.

from 19th and Sloat Boulevard—inbound via Ingleside, *stop-over* in city, outbound via Ellis & Ocean, to Parkside south returning to starting point.

Speed. Under present ordinances the City imposes the following restrictions on car speed, the limits fixed probably referring to *maximum* rather than schedule speed:

North of Market—
- 10 m. p. h. east of Larkin.
- 12 " between Larkin and Divisadero.
- 15 " west of Divisadero.

South of Market—
- 10 m. p. h. north of Division and Ninth.
- 12 " north of Duboce, Castro and 18th.
- 15 " south of Duboce, Castro and 18th.

For undirected vehicles such as automobiles, the limit applied is 8 m. p. h. within the fire limits and 12 m. p. h. outside. These speed limits as applied to street cars should be either raised or removed since they are *impossible of fulfillment* if the railroad is to operate at all. To obtain a reasonable schedule speed and at the same time keep acceleration and retardation rates within limits comfortable to passengers, speeds of from 15 to 20 m. p. h. between stops must be reached. The convenience of the riding public is predominant, and it is illogical for the City to place burdensome restrictions upon *directed* vehicles under power brake control upon which practically the entire population of the city depends for transportation. Every reasonable facility should be afforded the railway to inaugurate the fastest possible schedules consistent with safety.

Running Time. The great variation in running time to various parts of the city is accurately shown in the time zone map, Plate 3. Thus, in Richmond, 33rd Avenue is reached in 30 minutes while on Union Street the 30-minute zone only reaches the Presidio. and on Lincoln Way via Ellis & Ocean only Ninth Avenue. Likewise it is possible to go 30% further south in the Mission than via San Bruno Avenue. Roughly speaking, the 30-minute zone extends from Baker's Beach to South Basin, embracing about *one-half of the city*. It is safe to say that by logical and direct routing, running time on some lines may be improved perhaps one-fifth, particularly into Sunset, Merced and San Bruno districts. In many cases, shorter and fewer stops may be taken advantage of to considerably increase midday schedule speed.

Tandem Operation. Two-car stops and crossings have been put into practice on Market Street with marked success.† The crossing

†This improvement was recommended in Chapter 6—Relief of Congestion on Lower Market Street.

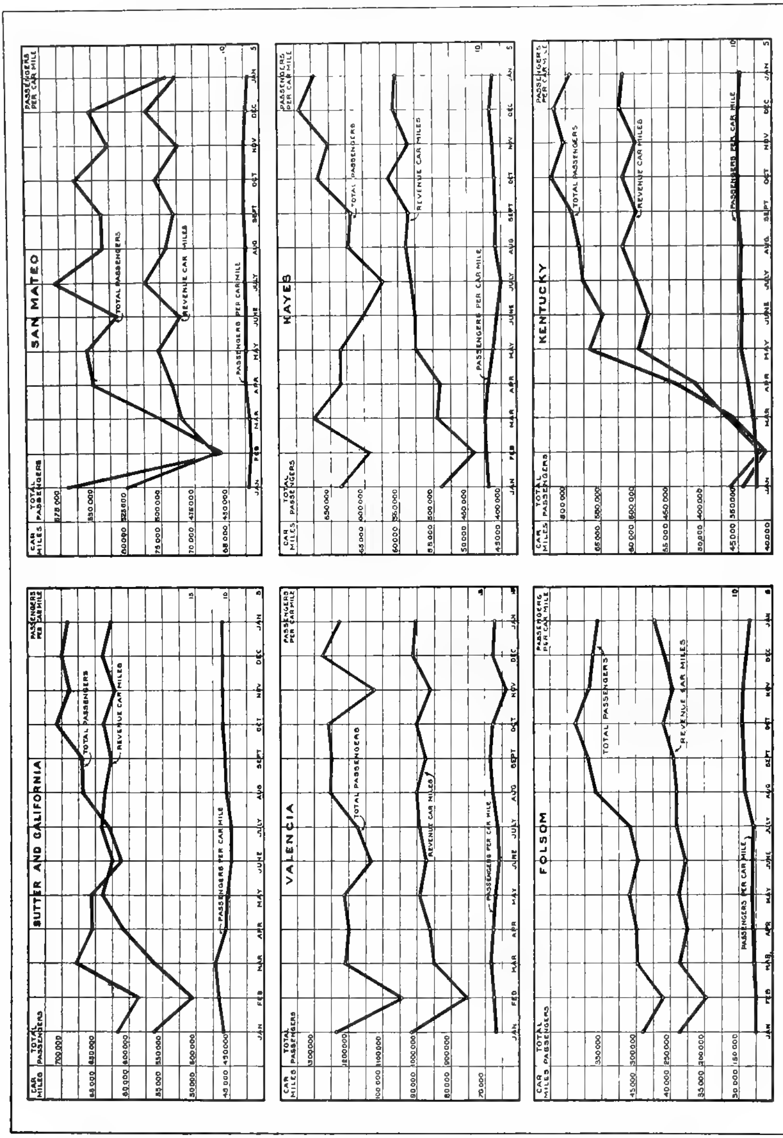

FIGURE 43—TYPICAL SEASONAL VARIATIONS IN CITY TRAFFIC.

Railway service in San Francisco is unusual in the slight variation from season to season, as compared with other cities. These curves show typical traffic characteristics of various routes in the record of, (a) passengers carried; (b) car miles run; and (c) ratio, passengers per car mile. Car mileage should be approximately proportional to the travel; and under ordinary conditions, if service has been properly distributed from time to time, the ratio—passengers per car mile on any line—should remain about constant, which furnishes an index of how much attention is paid to variation of traffic and proper service distribution. Within certain limits this ratio indicates also the relative loading of cars

capacity at congested points has been practically doubled, and about ten minutes delay in running time on Market Street has been eliminated. But the enlarging of the loading platforms to the recommended dimensions and a systematic method of car dispatching still remain to be perfected, especially in connection with the additional traffic expected from Geary and Sutter Streets.

Limited' Stops. While in the loading district frequent stops are to an extent unavoidable, it is necessary to increase the spacing in the outlying districts in order to attain a more satisfactory speed. A minimum distance between stops of 500 ft. is entirely reasonable, and even this permits a schedule speed of only about 7 miles per hour if all stops are made. In the Western Addition the stops are fortunately spaced as much as 481 ft. apart along trunk lines; but in the Richmond and Sunset districts the blocks east and west are only 310 ft. long, which practically necessitates *stops at alternate streets.* This should not be regarded as a hardship, especially since it is just about equivalent to a *stop at every block* in the north-south direction. In such localities, discrimination could be avoided by stopping inbound cars at *even* numbered and outbound cars at *odd* numbered streets. In future subivisions, care should be taken to approximate a 500 ft. block with the long side in the direction of trunk lines.

In all parts of the city where the stopping point is not clearly defined by street locations, white posts, suspended signs, or *trolley poles painted white* should be used to fix the location, especially where stops at alternate streets are made.

STOPS PER MILE

Street	Section	Possible stops per mile Average	Actual stops per mile Average	% Actual stops to possible stops	Average distance Actual
Folsom	Ferry to Army	10.0	10.0	100.0	528 ft.
Sutter and Sacramento	Market to 1st Avenue	11.4	9.0	79.0	587 "
California	1st Ave. to 33rd*	17.3	12.5	72.2	422 "
3rd & Kearny	Broadway to Berry	11.6	11.6	100.0	455 "
Kentucky	King to 33rd Ave.	13.2	7.7	58.4	686 "
Market	Ferry to Castro	10.5	6.9	65.6	764 "
McAllister	Market to 1st Ave.	10.7	9.8	91.5	538 "
Fulton	1st Ave. to 48th*	16.5	6.0	37.4	880 "
Sacramento	Market to Fillmore	11 4	11.4	100.0	464 "
Polk and Larkin	Market to Lombard	15 4	14.8	96.0	356 "
Fillmore	Market to Broadway	14.6	14.2	97.4	372 "
Haight	Market to Stanyan	10.9	10.9	100.0	485 "
Lincoln Way	1st to 48th*	16.5	5.0	30.2	1056 "
Mission	Ferry to 26th	8.6	7.5	87.1	703 "
Geary	Market to Presidio	11.1	9.4	84.7	562 "
Geary	Presidio to 10th Ave.*	17.8	16.1	90.3	328 "

*Alternate stops should be made.

"Car Full" Signs. While generally distasteful to the American public, this method of securing limited loading of cars is justifiable to avoid extreme variations in loading and headway, and increase schedule speed by making fewer and shorter stops. Better service will in the end result, provided of course that a sufficient number of cars are operated.

Headway. Variations in headway during the rush hour are often unavoidable, resulting from the excessive congestion and delays at street crossings and loading points. Numerous observations, however, show that even during the midday there is a wide variation in headway, which could be reduced by a more careful system of dispatching and inspection, especially at terminals. In many cases one car "creeping" on series to avoid overrunning its schedule at terminal may disarrange the headway of an entire trunk line.

Electric Switches. The present use of electric switches controlled by the motorman from the car platform is commendable, and important branch-offs should be so equipped in order to reduce delays at intersections.

Observed Infractions of Operating Rules, and Suggested Revisions

1. Trainmen not to smoke while on duty. Passengers on owl cars not to smoke in closed section of car.

2. Cars to be started only after signal from conductor. Inspectors or traffic police should stand at rear step and prevent passengers from boarding after rear platform is crowded and car is ready to proceed.

3. As the topography of the route dictates the rules to be followed by cable cars, special rules are necessary for each separate line. A far-side stop at all street intersections, and especially at railway intersections, should be used in preference to a near-side stop, thus minimizing the chance of accidents if a defective cable should make it impossible to control the car.

4. Over-crowding of cars until the rear platform, fenders and wheel guards are used by patrons can not be remedied except by the addition of more cars to the service.

5. Bulky packages permissible on cars should be loaded on front platform instead of being carried through car, and only when passengers are not delayed in transit.

6. Both trainmen should not leave the car at the same time during a blockade or while car is delayed on its run.

7. At intersections, cars on straight tracks should have right of way over "branch off" cars. Cable cars should have unquestioned right of way over electric cars, and should use this advantage in making far-side stops. This rule is imperative, but infractions are common (as at Sutter and Powell Streets).

8. Conductors should announce all streets and transfer routes.

9. Route signs should be correctly displayed and changed to indicate the destination of the next half trip at the terminal only. If it is necessary to "short run" a single car, an announcement by the conductor to all boarding passengers and the issuing of emergency transfers should be required.

10. Cars should not leave transfer points so quickly as to prevent the transfer of passengers from an intersecting car that has reached the stopping point before the waiting car is ready to proceed. This rule should be followed on cross-town lines especially, and on all lines during the light hours of travel.

11. Reckless running on heavy down grades to make up time should be distinctly prohibited, and penalized.

12. Power should be shut off at street intersections whether or not a stop is made.

13. Gong should be sounded before cars are started.

14. Gates on the front platform of a prepay car should be opened at every stop, to encourage forward movement through the car.

15. Buzzer signals operated by passengers should be recognized by the motorman without additional signal from the conductor.

PART III

IMPROVEMENTS IN ROLLING STOCK

CHAPTER 8

DESIGN OF NEW ROLLING STOCK*

Municipal Railway Cars, Geary Street Line
United Railroads 1912 Car, "California" Type

A very important factor in determining the attitude of the public toward a street railroad is the adequacy of the equipment used; and where the road is municipally operated it is especially important to maintain the highest standards. The essentials are: (a) comfort of passengers consistent with reasonable capacity; (b) rapid loading and unloading; and (c) minimum interference with other vehicles. This chapter embodies detailed recommendations for the construction of the municipal railway cars, covering type, general design, and seating and platform arrangements; also recommendations for modifying the proposed design of the new 1912 United Railroads car, calculated to make it more suitable either for (a) standard equipment, or (b) operation on special lines only.

I. MUNICIPAL RAILWAY CARS

After close observation of the various types of cars in use in this city, in Oakland, Berkeley, and the other bay cities, and taking into consideration the weather conditions that prevail in the City of San Francisco throughout the year, I am of the opinion that a car having a closed section and one or more open sections will be more satisfactory to the patrons of the Geary Street line than a completely closed car.

I am also satisfied that if such a type of car can be equipped, in the main, with cross seats which can always be made to face forward, the advantages of having the combination of the open and closed feature with the cross-seat feature will be instrumental in encouraging traffic which would otherwise be lost if the line were equipped with closed cars.

If, to the above advantages, there is added the pay-as-you-enter principle properly applied, which has proven to be advantageous in other cities, not only in the reduction of the number of accidents to passengers, but otherwise, a car will be secured which in my judgment will be best adapted, all things considered, to the San Francisco climate and to the Geary Street line.

In determining a suitable seating arrangement of the car, various combinations of seats have been considered, with the object of de-

*Formerly Preliminary Reports No. 1 and 7-I, submitted Feb. 7, and Aug. 21, 1912.

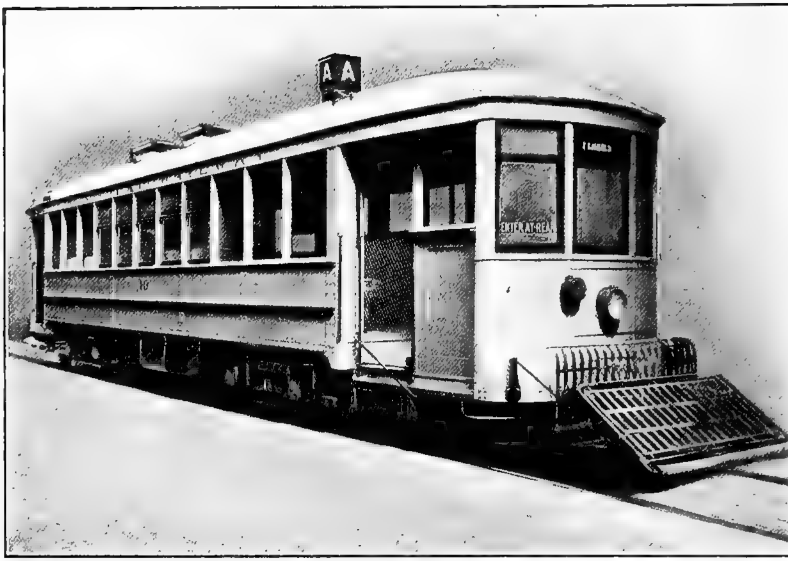

FIGURE 44—NEW MUNICIPAL RAILWAY CAR.

Embodying the most advanced standards of comfortable seating arrangement, quick loading and unloading, rapid operation and safety in a "California type" prepayment car. This design conforms to the Chicago standard, making it possible to save 18 inches from the width of roadways, while still preserving ample passenger carrying capacity according to standards that may be properly imposed by the municipality in railway service, either on its own lines or those of private companies. This car can comfortably accommodate from 80 to 90 passengers, or 105 in emergencies, without undue crowding. During the first few days of operation loads as high as 145 passengers per car were carried.

termining upon an arrangement which would provide maximum comfort to passengers together with adequate capacity for handling loads at times of maximum travel. Fundamentally, a car adapted for handling maximum loads (that is, one possessing the maximum number of seats as well as the maximum carrying capacity) is a car equipped throughout its length with longitudinal seats facing inward. On the other hand, the car providing maximum comfort for passengers and minimum overload capacity is one equipped with cross seats throughout its length, facing forward. The problem, therefore, is to provide a car which will give maximum comfort to the greatest number of seated passengers, and at the same time provide sufficient reservoir or storage space for standing passengers so as to rapidly absorb the inflow of passengers at times of maximum travel; and I believe the arrangement above recommended, seating 44 people comfortably, will best meet the conditions prevailing on the Geary Street line and its probable connections.

Specifications for both steel and semi-steel cars for this line, previously prepared by engineers for the City, have been submitted to me and they call for thoroughly first-class construction and show evidence of careful design; and had cars built to these specifications been purchased by the City, the line would have been equipped with high-grade rolling stock of the closed type. But in reviewing these plans and specifications it has occurred to me that certain modifications, if adopted, would make a car somewhat lighter and I believe better adapted for service on the Geary Street line, the principal changes being as follows:

1. The abandonment of the fully closed car body feature, and the substitution therefor of a partly closed and partly open body type with the closed part in the middle and the open parts at the ends.
2. The substitution of raise sash in the closed portion of the body for drop sash, thus permitting a lighter and narrower construction, the recommended car being 8′ 6″ wide instead of 8′ 9″.
3. The elimination of glass windows in the open parts of the car, leaving only flexible drop curtains, thus saving some weight and the cost of furnishing and maintaining windows and sash.
4. The substitution of the arched roof for the monitor deck type, the former making equally as good as well as a lighter and stronger car for less first cost and also one which will permit adequate ventilation in the closed part of the car by means of automatic ventilators of a suitable type.
5. The introduction of automatic exhaust ventilators in the closed portion of the car with provision for ingress of fresh air when the doors of the closed compartment are closed.
6. The rearrangement of the operating apparatus on the platforms, such as controllers, air-brakes, hand-brakes, etc., changes in the design of the guide rails, and the adoption of the small master controller of the remote control system, all of which will greatly increase the reservoir capacity of the platform and permit rapid loading by allowing a greater number of passengers prompt access from the street to the platform. This will enable the car to start and get away quickly instead of waiting for these passengers to file singly by the conductor before the starting signal may be given.
7. The retaining of the advantages of the cross-seat feature and adding four additional cross seats (all of which are located in the open section of the car) thus permitting part of the outside riders to ride face forward instead of facing inward, al-

FIGURE 45—DETAIL VIEWS OF THE MUNICIPAL CAR.

These photos illustrate some important features of the new cars operating on Geary Street—(a) unobstructed entrance way to facilitate rapid loading, (b) open bulkhead at the ends to eliminate cramped entrances, (c) maximum comfort by the use of many cross seats, (d) maximum standing space opposite entrance, (e) protection of motorman by removable guide railing, (f) easy forward exit next to car body.

though, in order to get sufficient reservoir space in each end of the car to absorb passengers rapidly when entering, it is necessary to have at least one longitudinal seat in each open section.

8. The elimination of the doors at each end of the car and the adoption of an open bulkhead type similar to cars now in operation in Oakland and Los Angeles, which arrangement allows greater storage capacity at times of overload, and permits easier ingress and egress of passengers.

9. The substitution of a jointed or hinged guard-rail, manipulated by the conductor, or a railing cut off some distance back from the step stanchion which will permit the entire width of entrance of the rear platform to be used for loading at times of

excessive congestion. Such a device is now in successful operation by the Oakland Traction Company.

10. The location of the forward exit gate next to the body corner post instead of next to the vestibule bulkhead in order to avoid the necessity of a passenger forcing his way through a crowded platform to reach the exit gate.

In the Appendix is a brief digest of the revised specifications presenting the essential points in the recommended design.

II. UNITED RAILROADS 1912 MOTOR CAR

From the standpoint of the public, the various items in the make-up of a complete car to be subjected to analysis are as follows:

(1) Seating arrangement.
(2) Facilities for quick loading and unloading.
(3) Storage space—platform and car floor.
(4) Car proportions, with reference to street clearance.
(5) Height and type of steps.
(6) Ventilation and lighting.
(7) Designating signs.

The proportions of the 1912 car are practically the same as the later equipment now in service on Sutter Street, and, excepting width, also approximate the proportions of the Geary Street cars; that is, as regards truck centers, wheel base, length of body and platform, and height. The arch roof used (sometimes called the turtle-back roof), however, is new to the United Railroads practice, except in the case of a few remodeled cars which have been built in the Company's shops and have been placed in service within the year (1912). And except in the case of these few cars, and the Municipal Railway equipment, the 1912 design embodies for the first time in a San Francisco prepayment car the "California" type arrangement of car body with closed and open sections.

Considering these two designs together from the standpoint of the most suitable car for the City of San Francisco, I believe the Geary Street is superior, although even it may require some minor modifications as a result of experience with the initial order. The two differ materially in the matter of seating arrangement and width of car.

Inasmuch as this new equipment may possibly operate on the Sutter Street lines in competition with Geary Street, the following comparison will be of interest. Only such features as differ materially from the Geary Street cars or require further modification are compared herein for discussion.

ESSENTIAL DIFFERENCES IN DESIGN

	Geary Street	United Railroads
1. Proportion of cross seats to total fixed seats	73% (exclusive of platform seat)	45% (exclusive of platform seat)
2. Longitudinal seats	Half of end compartments on entrance side	Entire closed compartment
3. Average spacing of cross seats	30½ inches to 31 7-32 inches	29 inches
4. Principal standing space	End compartments, opposite entrance way	Middle or closed compartment
5. Seat proportions	17 inches by 34 inches	16 inches by 32 inches
6. Width of aisle	27 inches at hip line	40 inches at shoulder line
7. Width required for seat over-all	37 inches	35 inches or more, depending upon the type used.
8. Width of car body over-all	8 feet 6 inches	9 feet 2 inches
9. Platform	Tapered to provide clearance at curves	Straight sides
10. Minimum rear entrance width on platform	40 inches	32 inches, due to contraction of hand-railing, location of and difference in types of controller
11. Bulkhead width	Open between corner posts 69 inches	False partitions, opening 53 inches
12. Position of exit door	Next to car-body bulkhead	Next to car bumper, with seat intervening
13. Minimum exit width	29 inches	27 inches
14. Guide rail	Motorman protected by movable guide rail	Guide rail raised. No protection for motorman
15. Type of step	Folding type, raised on blind side of car	Fixed steps
16. Platform fixtures	Master type controller to reduce space occupied	Type K control opposite narrowest entranceway
17. Window sash	Raise sash in closed sections	Sash fixed
18. Storm protection, open section	Drop curtains	None
19. Ventilators	Automatic eductors in roof, and floor intakes	Intake and exhaust funnels
20. Sanders	Positive air blast sanders delivering close to wheel	Gravity sanders

The improvements which I am able to recommend depend to a large degree upon the service intended, that is, whether this new equipment is intended for general use in all parts of the city, *i. e.*, interchangeable *as regards routes*, or for operation on certain lines only. *In either case* the following improvements should be included:

RECOMMENDATIONS

(1) Taper platforms, to provide for future clearance operation.
(2) Front exit gate next to the bulkhead.
(3) Straightened guide rail to provide greater entrance width, or
(3a) Conductor's stand in center of bulkhead opening and elimination of present form of guide railing.
(4) Motorman protected by movable guide rail.
(5) Geary Street or equivalent seating arrangement.
(6) Cross-seat cushions 17″ x 34″, spacing 30 inches or more. All cushions spring-backed.
(7) Raise sash in middle or closed section.
(8) Bulkhead open between corner posts.
(9) Folding steps instead of fixed steps.
(10) Storm curtains or equivalent protection.
(11) Ventilating intakes in floor or sides of the car.
(12) Positive air blast sanders.
(13) More liberal spacing per passenger for longitudinal seats where vertical stanchions are used in place of straps.

For a Future Standard Car:

(14) Over-all width 8′ 6″, track centers not less than 10′ 2″ (sidewalk width 11′ to 12′ on 68′ 9″ street), giving two-line vehicle traffic on all streets.

Note—It is understood that the United Railroads now has in contemplation the following modifications of the original plans:

1. Moving front exit gate next to bulkhead.
2. Cleveland arrangement of fare box and guide rail. (See p. 205.)
3. Cross-seat cushions 17″ x 34″.
4. Bulkhead posts to be flared back to increase shoulder width at entrance.
5. Sliding or folding step.
6. Storm curtains, if satisfactory on Geary Street cars.
7. Ventilating intakes if found necessary.
8. Removal of fare box from entrance way.
9. Vertical stanchions in closed compartment set out to knee line.
10. Platforms to be tapered, when improved type of fender is developed.

GENERAL DISCUSSION

Seating Arrangement. In the Geary Street cars I have preferred to locate the principal storage space in the open section, while the reverse is true in the United Railroads design. My reason for so doing is in recognition of the fact, determined by observation, that the average passenger rides *less than two miles* along a given route before alighting. This means that the short-haul passenger greatly predominates, and consequently that extra space must be provided for persons disinclined to move forward because of a short trip ahead.

On the other hand, the United Railroads provides this extra storage space by using longitudinal seats in the closed section to *encourage* people to move forward in order to clear the rear part of the car for newcomers, and also for the reason that during stormy weather, longitudinal seats will accommodate the maximum number of persons desiring to be protected.* However, the United Railroads design provides no sash in the open sections, nor storm-curtains, as does the Geary Street car. It is possible that the storm curtains for the latter may not prove a perfect appliance for this purpose, but in the absence of something better I certainly should not consider it wise to spoil such a good seating arrangement as in the Geary Street cars on account of a short period of inclement weather.

One method of encouraging passengers to move forward is to limit smoking, by ordinance, to the front open section, thereby inviting forward a fair proportion of the passengers immediately after entrance. The serious objection to the United Railroads layout is that the passengers entering the car body are immediately forced into the center of the aisle, counter-current to those passing out through the rear exit. On the other hand, the side seat plan as used in the Geary Street car provides not only a relatively wide passageway, but also an offset aisle which will tend to separate lines of entering from leaving passengers.

Experience in other cities tends to show that longitudinal seats do not attract street car patrons—cross seats, quite the reverse. Consequently, the advisability of thus using all longitudinal seats in the center or closed section is very doubtful, especially with so wide a car as proposed. The fact that riding in San Francisco is extremely short-haul justifies the use of a certain percentage of longitudinal seats; but they should be

*As a matter of fact, the contraction of the aisle at the ends instead of the center tends to defeat the very purpose in view by checking free forward movement right at the entrance.

placed where most needed, and in this respect the Geary Street car design is, in my judgment, the more desirable for the present car. The best that can be said of the United Railroads seating arrangement is that it is a considerable improvement over some of the present equipment, with the exception of the so-called "Chicago" car, which may be identified by class numbers 1500 to 1549, and the half cross, half longitudinal seat type, represented by class numbers 1550 to 1749. In the latter, the longitudinal seats run as far as the center of the car on the one side, then for the remainder of its length on the other side, thus approximating the Geary Street arrangement except for the central closed section.

Width of Car. As a result of experience and observations in Chicago during the complete rehabilitation of the transit system, it would seem that the adherence to a car as wide as 9′ 2″* in San Francisco is a mistake, provided that a future standard is under discussion. If all of the streets of the city were of the generous proportions of those of the business district south of Market Street, the necessity for limiting the car width would not arise. Unfortunately, however, the streets of the 50-Vara district and Western Addition are, as a general rule, only about 68′ 9″ in width. And, still more unfortunately, the track centers have been standardized at a distance of 11′ 0½″ in order to secure an ample width of "devil strip"—22½ inches between cars. This width undoubtedly represents good practice, although a width of 20 inches is sufficient where street widths are limited. Unfortunately, again, the sidewalks in the 50-Vara district and Western Addition are fixed by ordinance at 15 feet in width, which is too great to permit *two-line vehicle traffic on each side of the street.* In order to secure reasonably rapid transit, two-line vehicle traffic is absolutely essential, to enable slow-moving vehicles to keep next to the curb, rapid vehicles passing between them and the car. If the usual proportion in sidewalk width were in vogue, viz.: one-sixth of the width between building lines, the sidewalk would be approximately 11½ feet wide. Then with the narrower car—8½ feet in width—and a 20-inch "devil strip," there would be ample room for two lines of vehicles on either side. Under present conditions two-line traffic is impossible, as a 15-foot sidewalk only permits a single line of vehicles. Therefore, at the present time, the wider car will offer practically no greater obstruction to street traffic than the narrower car, in the Western Addition district. (See Figure 46.)

*Width over belt rail, 9 feet 2 inches; over body, 9 feet.

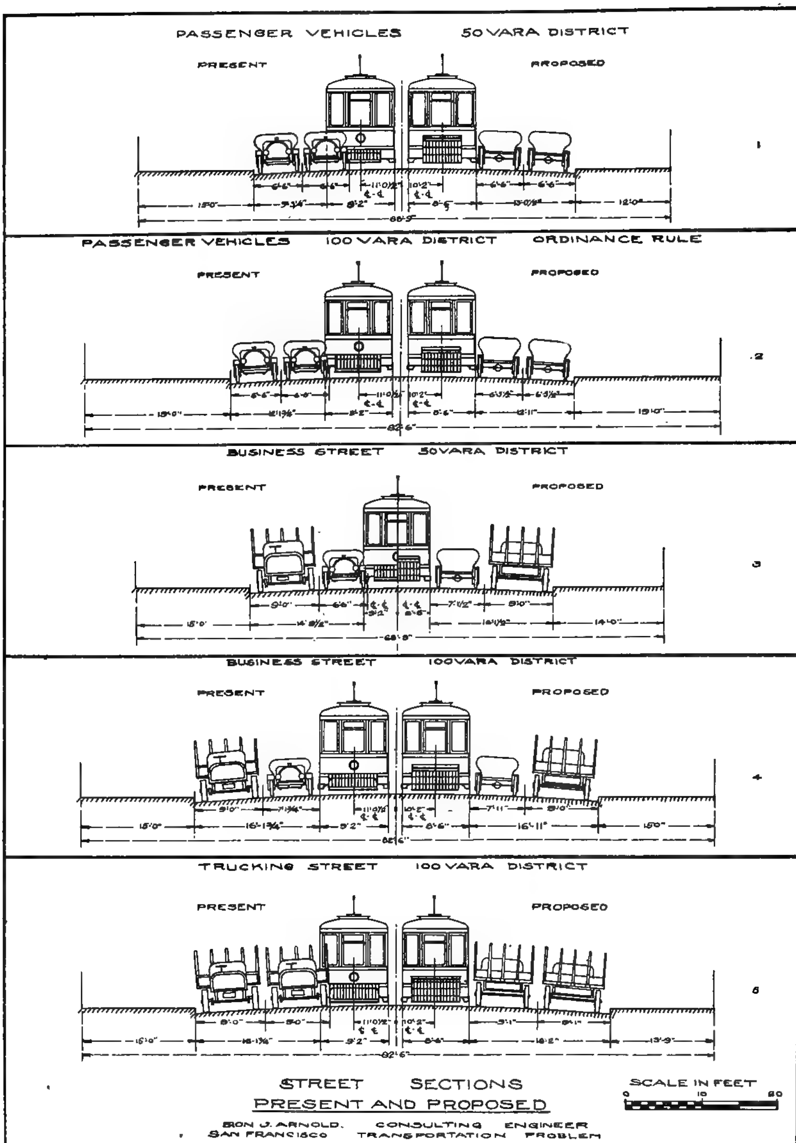

FIGURE 46—COMPARATIVE DIAGRAM OF STREET SECTIONS.

Showing the possibility of more efficient traffic operation through redistribution of the available street width by reducing sidewalks and using the Chicago standard of car width (8′-6″) and track centers (10′-2″) thus saving 18 inches from the roadway. Freeway between cars and vehicles standing along the curb is essential for rapid surface transportation.

(1) Standard street, 50-Vara district. Sidewalk reduced to 12 feet. (2) Standard street 100-Vara district. Two-line vehicle traffic possible only with narrow car. (3) Business street, 50-Vara district with single-track car line. Two-line mixed traffic difficult without reduced sidewalk. (4) Business street, 100-Vara district. Sidewalks 15 feet wide permit two-line mixed traffic with either car. (5) Trucking street, 100-Vara district. Sidewalk decreased to one-sixth of the street width.

It is entirely possible,† however, that future steps may be taken to reduce the width of sidewalks in order to clear some of these streets. And, in addition, considering the new streets which will be improved and electrified from time to time, *it is not too early to establish a standard* which will make these things possible. Narrowing of the track centers in order to require less of the roadway width than at the present time must be effected to carry out this plan. This can only be done gradually on extension and rehabilitation work, but ultimately the entire city will be brought to one standard.

For an 8′ 6″ car 10′ 2″ track centers may be used, as is the present standard within the city of Chicago. This combination makes available for vehicles *18 inches more of roadway* than under present conditions. The desire of the United Railroads to furnish the maximum width of aisle by using the wider car is indeed laudable, but when it is considered that the wider car is obtained at the expense of narrowing the roadway, I cannot recommend it, especially when a width of aisle, 27 inches between seat backs, has proven sufficient in so congested a city as Chicago.

Seats. The seat proportions proposed do not appear to be liberal enough, especially for so wide a car. For comfort, cushions should be 17″ x 34″, and all seats in the car spring-backed. This requires a longitudinal spacing of at least 30 inches, preferably more. In the 1912 car, the dimension of the closed section has resulted in cramping the spacing of cross seats in the open sections to 29 inches. This should be increased. The size of the closed section is determined by the number of seats and the spacing allowed per person. Although the design calls for 17¾ inches per passenger, which is fair, the effective spacing has been reduced by the provision of vertical hand rods or stanchions at alternate seats, extending from the floor to the roof at the seat line. These hand rods reduce the actual spacing between stanchions to 34 inches, which is not sufficient to allow two persons to rise together comfortably. Moreover, these stanchions in the present position will probably prevent uniform seating, inasmuch as there are no fixed divisions between the seats. They require six inches additional length in the closed compartment, which if applied to the open compartments, would increase the seat spacing to thirty inches—some improvement over the present design.

However, where longitudinal seats are used, these stanchions are desirable in place of straps, for the assistance of standing pas-

†Now being done on some streets in the Western Addition.

sengers, and if covered with white enamel as in modern rolling stock, they are sanitary and convenient. But in the absence of a more liberal spacing, they should be set out at least to the knee line, in which position they would interfere less with seated passengers, and would be fully as convenient for standing passengers as in the present plan. Without very liberal seat space per passenger, partitions must be used between seats if stanchions are to be set up against the seat line, and either condition requires so much extra length of car body that the number of cross-seats in the open sections is reduced from six to four. Therefore, with this car body the standard cross-seat arrangement within the closed section is preferable, or else the dimensions should be so modified as to obtain better results in both compartments.

Length of Car. This is limited by the permissible overhang of platform beyond the center line of trucks, and that of the projecting fenders used. On general principles, it is desired to increase the length of car body as much as possible, in order that the proportional cost of platform wages may be reduced and also the relative maintenance of parts. But, in any case, the platform overhang is the serious and determining factor, especially where narrow streets are encountered, owing to the resulting interference with adjacent car and vehicle traffic on curves. For prepayment cars, long platforms are necessary, and in order to reduce the overhang of the ends, trucks must be located as far apart as possible, and still keep the center overhang within reasonable limits.

In the case of the 1912 type of car, the proportions have been worked out to secure probably as good a design as could be produced under the conditions existing in this city. The distance between truck centers and car platforms is practically the same as in the Geary Street car. In either design, the end overhang cannot be reduced because of interference of trucks with the projecting underhanging platform side sills. In reasonably flat cities, two-motor, maximum traction trucks, with pony wheels extending out under the platform can be used, thus decreasing to some extent the platform overhang. But in San Francisco, two-motor equipments are impossible on account of the greater tractive effort required on heavy grades.

The only remaining method of reducing car overhang is by tapering the platform so that the corners of the bumpers describe an arc of somewhat shorter radius. In this respect, I cannot recommend the 1912 car, because of the fact that the platform has been designed of the same width as the car body on the assumption that with the use of a fender, the platform actually presented

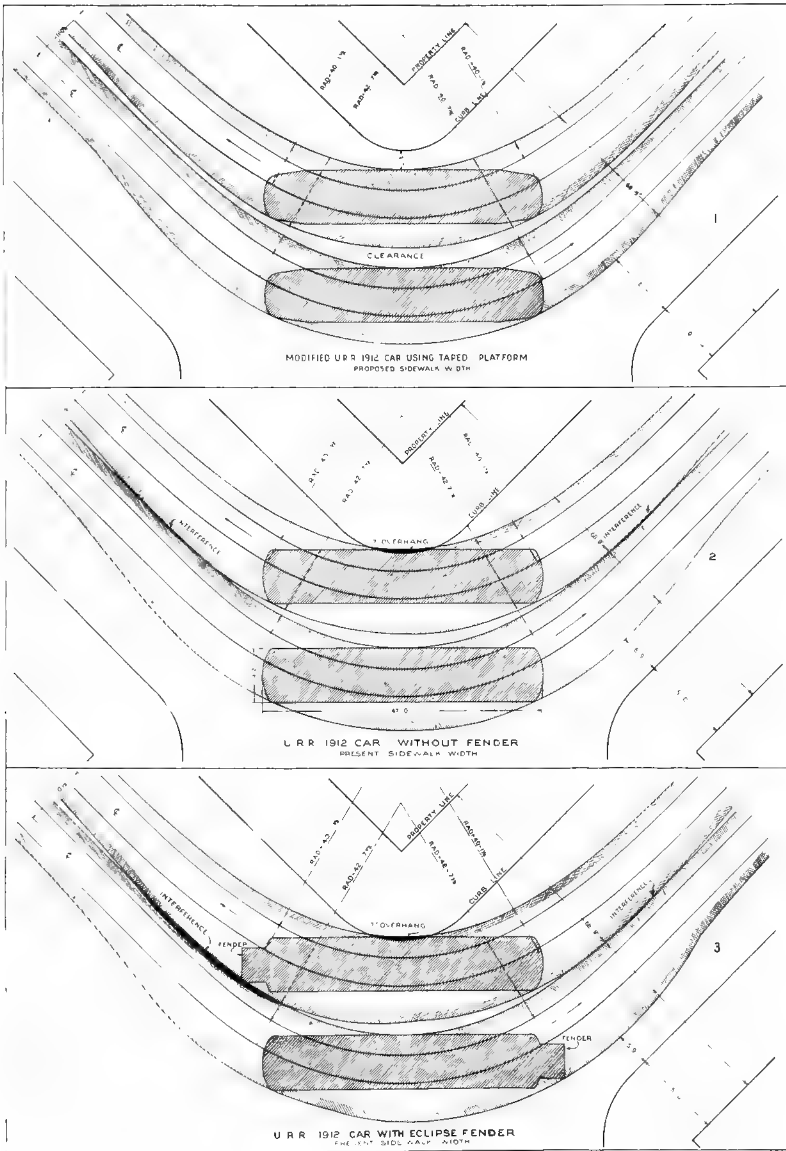

FIGURE 47 -STUDIES OF CAR CLEARANCES ON CURVES.

In any system of routing where curves are encountered a fast schedule requires that cars may pass on all curves without interference or delay. But owing to the present fender, clearance operation is impossible with such curves as may properly be used in the existing narrow roadways, either with present or new equipment. In view of the possibility of a more satisfactory fender being developed, tapered platforms have been uniformly recommended. These diagrams represent by shaded lines the area swept over by various cars in rounding standard curves. With 11-foot sidewalks, overhang at inside curb is avoided, but tapered platforms are necessary in any case to provide clearance operation.

less overhang around curves than the corner of the fender, which now prevents clearance operation. But even assuming that this is true, it should not be assumed that the present type of fender is to be permanent.

Clearance operation is very essential in any system of rapid transit, surface or otherwise, and it is a fact that through the adoption of the "Eclipse" fender, specified by the Board of Supervisors, the clearance operation of cars around curves in San Francisco has been entirely nullified. Nevertheless, the development of a new car for either present or future should not embody this purely temporal condition and render clearance operation impracticable or dangerous. Consequently, tapered platforms should be embodied in the design. (Figure 47). The only alternative is for the City to permit the spreading of tracks at curves sufficient to clear present fenders, which would result in an overhang of 15 inches over the standard curb of the Western Addition district.†

Platform Arrangement. Generally speaking, there is a certain relation between the area occupied by passengers in the car body and that of the platform; *i. e.,* the larger the car, the more platform space is required. Where the prepayment principle is used, it is particularly necessary that ample storage space be available on the platform in order to avoid delaying the schedule due to slow loading, as would be the case with the short platforms. Moreover, every restriction placed in the way of free entrance of passengers must be removed. In the 1912 car, the principal difficulty is this contraction of the entrance space—first, by cramping the railing into the entrance passageway; and, second, by locating the controller directly opposite the contraction. There are three ways of improving this defect:

First: By straightening out the guide railing so as not to cramp the entrance way;

Second: By use of the master control system; and

Third: By placing the fare box opposite the center of the bulkhead opening with the conductor standing between.*

With the remote control system, only a very small master controller box is necessary on the platform, while the actual contact devices, connected thereto by an electric circuit, are all located underneath the car.

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†With standard spiral easements at present used throughout the United Railroads system, the 1912 car theoretically clears on curves with a margin of four to six inches on the wider streets, and less than one inch on the narrower, exclusive of fender. But even this clearance is out of the question on account of the possible list of the car on curves from various causes, such as eccentric loading, depressed rail, worn side bearings, failure of springs, etc.

*A similar plan is at present in operation in Cleveland and indicated in Plate 12.

In the third method the present form of guide railing is entirely dispensed with, the guard rail for the fare box serving the purpose of dividing the bulkhead opening into entrance and exit passages. In this manner, the entire platform is open to passengers and the congestion at the entrance entirely eliminated.

For the new rolling stock, one or more of these methods should be adopted; and in any case, the front exit gate should be removed from its present location next to the bumper to a position next to the bulkhead. This is desirable so that passengers may alight quickly without having to force their way through standing groups which at present congest the space between the bulkhead and front exit gate.

By using the master control system as above proposed, and with the handrailing straightened, fully 50 per cent more entrance width will be available.

An advantage of the proposed location of exit gate next to the bulkhead is that two or three feet of length may be saved from each two-car safety station* along Market Street. At Kearny Street station particularly, this is of importance, owing to the difficulty in securing the proper length of station without interfering with street traffic.

In carrying out these improvements, the bulkhead should be left open with the maximum width between corner posts, in order to secure ample entrance and exit space. This is a definite advantage of the so-called "California" type of car, and the entrance and exit should not be contracted by false bulkheads such as wire screens or vertical railing.

Loading. San Francisco cars, unlike those of other cities, are called upon to handle two entirely different classes of service: (1) normal street traffic; and (2) terminal traffic at the Ferry, and it is the difficulty in handling large groups of passengers at terminals that has occasioned most of the recent criticism. In my judgment, the prepayment is by far the best system of operation that has been devised thus far, but it must be perfected for these special conditions of service.

More rapid loading at points of congestion can be secured by the use of a radius rod in the guide railing, such as used on the Oakland cars. By means of this radius rod, the entire width of step can be made available so as to increase the storage space at entrance, and thus load large groups of passengers more promptly than if half the step were used.

As an alternative, the radius bar may be omitted and the hand railing cut off about 24 inches back from the step, in a measure

*Recommended in Chapter 6, Fig. 32.

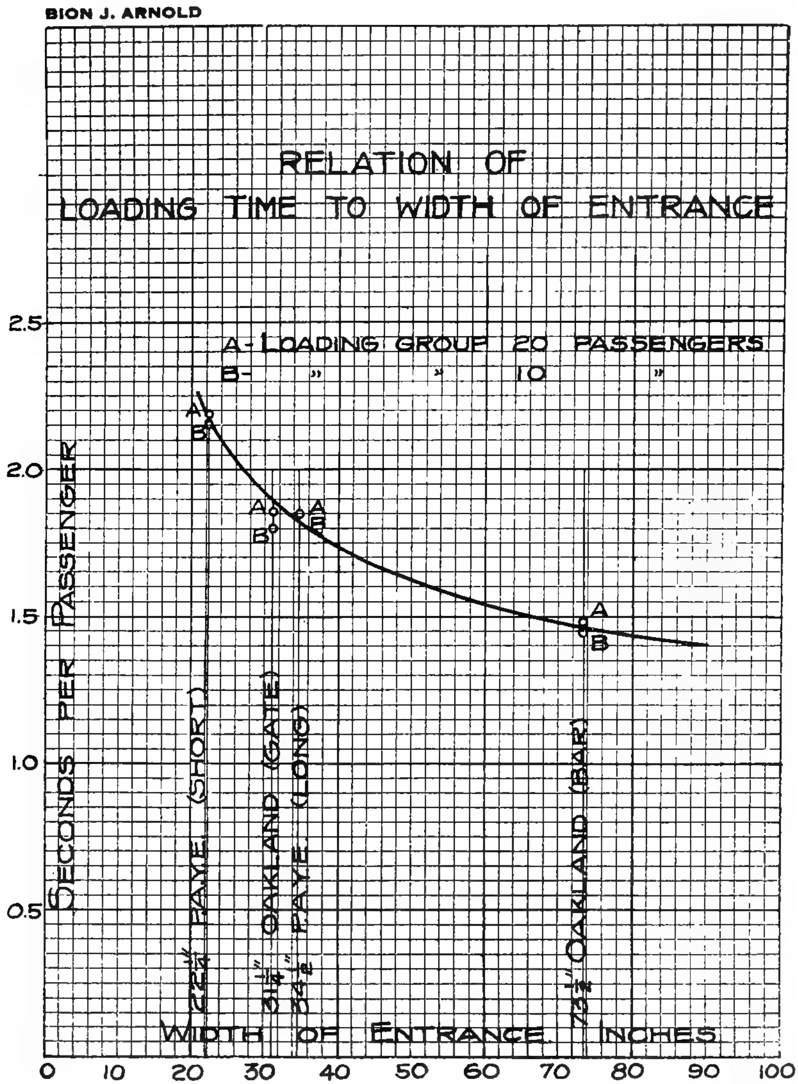


FIGURE 48a.—EFFECT OF ENTRANCE WIDTH ON LOADING SPEED.

Based upon observations of the relative time required to load a given group of passengers through wide and narrow entrances. These results conform in character to similar observations made upon different sized cars in Chicago, where, however, the loading is faster, due to improved platform arrangements. The data show that the largest San Francisco platforms now in use require 27 per cent more time in seconds per passenger than the Oakland cars using the radius rod.

accomplishing the same purpose. This plan is now in use on some of the United Railroads cars.

Still another method of accomplishing the same result is by changing the position of the conductor's stand from the platform to the entrance of the car body as previously described (page 190), and by the elimination of the present form of guide railing. By this arrangement not only is the full step width made available for entrance, but the entire platform area can be used as storage space for passengers waiting to pay their fare.

A graphical demonstration of this relation between loading speed and width of entrance is afforded by Figure 48a, based upon observations on different widths of entrance at the step line. It will be seen here, that the long platforms of San Francisco require approximately 27 per cent more time in *seconds per passenger* than the Oakland car, using the full width entrance with the radius bar swung over to the bulkhead.

At the Ferry and other heavy terminal points, it is very necessary that the platforms at both ends of the car be available for prepayment entrances. This may be accomplished in two ways:

First: By turning the front *exit* gate into an entrance gate, in which case only half of the full width between posts is available for entrance after the car is emptied.

Second: By opening the blind side of the front platform for the full width between posts for rapid exit, using front exit gate for entrance only.

Height of Steps. The height of steps involves many more details of design than appear upon the surface. In fact, to eliminate the last inch of height may require the redesigning of the trucks, bolsters, and car underframing. Furthermore, it must be recalled that any figure representing height of step is subject to considerable fluctuation due to the following causes:

First: After usage, the truck springs show a tendency to set, which may amount to from ¼ to ½ inch.

Second: Under maximum car load, the springs may compress 1¾ to 2½ inches.

Third: Due to wear, the wheel diameters decrease from 34 inches, new, to 31½ inches, maximum wear, dropping the entire car 1¼ inches.

Fourth: Due to wear of side bearings, steps may vary as much as one inch in height.

Fifth: Permanent sag in platform underframing.

Due to one or all of these causes, the step of a properly designed car may drop from 2 to 4 inches from its position when new. Were

the car originally designed with this low step, wear and stress would result in the platform lowering to a point where it would interfere with the operation of the trucks. Consequently, to secure this necessary truck clearance, the new cars must be designed with proportionately high steps.

The 1912 car submitted by the United Railroads appears to show careful design with respect to this step height, and the cars, when new, will have the first step about 15 to 16 inches from the pavement, which may eventually be reduced to 12 inches by wear and settling.

In the Geary Street car, a simple device was made use of to reduce the height of step between platform and car body, in which the car floor was inclined from the center line of the bolster toward the end sill, so that the platform step is two inches lower than it would be with the level car floor. It is understood that this plan will also be adopted in the 1912 car, except that the platform instead of the floor will be sloped upward two inches in the form known as a ramp.

I regard it as very necessary that folding steps be used in the place of fixed steps. The object of the folding step is two-fold:

First. Lifting the steps on the blind side of the car will tend to discourage persons from endeavoring to steal a ride, and thereby incur the liability of accidents, as is the case when the steps are down.

Second: This practically obviates the possibility of collision or other interference with passing vehicles.

With the large number of overhanging steps now being operated in San Francisco, the danger from these two sources will be appreciated. In some prepayment cars, designers have even gone to the length of automatically raising the steps when the vestibule door or gate is closed, so that while in motion, the car is entirely stripped of steps in the lowered position. Cars of this type may be found on the College avenue line, Oakland, and in Boston and other cities.

Ventilation. Without having positive knowledge of the operation of the ventilating funnel shown on the 1912 car, I believe it should operate with fair satisfaction when the car is in motion. The principal objection I find is that there is no provision for the ventilation of the closed section while the car is standing still.

It is unquestionable that the fixed sash will result in slightly lower maintenance expense, but there will be times when it will be necessary or desirable to open the windows of the closed section. The Geary Street cars have raise sash, which is preferable to drop sash, on account of the increased cleanliness and the fact that the de-

creased thickness of wall may be taken advantage of for increasing the width of the aisle.

In conclusion, the 1912 United Railroads car may be regarded as a step in the right direction, and in general a considerable improvement over any of the types at present in operation here. It will prove fairly satisfactory for certain sections of the city where streets are wide enough to accommodate a wide car, as in the Mission.

Some features are quite commendable, such as the use of the turtle-back or arched roof and the position and type of illuminated signs; also the lowering of the steps by means of a platform ramp.

But if the design is intended for universal use throughout the city, or a standard for future equipment is under consideration, this car will require considerable modification.

CHAPTER 9

IMPROVEMENTS IN EXISTING ROLLING STOCK*

Improvements in Existing Types—Electric and Cable Report on Brake Equipment

With the high density of traffic in San Francisco, it is essential that cars using the prepayment method of fare collection are provided with every facility for rapid loading, in order to avoid congestion and increase both speed and line capacity. Unfortunately, most of the cars now operated are unsuited for the service, due to inadequate platforms, and this chapter recommends methods for increasing loading speed as well as other improvements calculated to better serve and afford maximum comfort for patrons. Also are included suggestions for a special "hill type" car and improvement of inadequate cable equipment.

This rolling stock may be best analyzed by class or type, as designated by serial numbers printed upon the ends and sides of the car bodies, so that they may be identified on the street. Sketches of the recommended changes and alterations are appended hereto. The most important classes to be considered are those having drop platforms, of which nearly 330 out of a total of 557 double-truck cars are now operated. The company is to be commended for its adoption of the more convenient drop platform as a standard instead of the flush platform, in spite of the greater cost and weight and the widespread use of the flush platform type in neighboring cities.

CONCLUSIONS AND RECOMMENDATIONS

1. The three improvements essential to the electric car equipment are : (a) an increase in platform loading capacity; (b) better unloading facilities; (c) improved seating arrangement. To secure the principal result, there are only two alternatives—either lengthen the platform, or else remodel the platform fixtures and remove the end bulkhead; possibly both will be advisable in some cases. These changes I believe will result in increasing the speed of passenger movement at least 25%.

2. Observations under different conditions consistently indicate that the time consumed in stops for loading and unloading

*Formerly Preliminary Report No. 7-I, submitted Jan. 20, 1913.

is entirely too great. Entrance passages should be enlarged, particularly on the short-platform cars, and at least the full width of the entrance step (*i. e.,* from the outer grab handle to the stanchion) should be preserved in the platform passageway as far as the last step or entrance door into the car body. This result may be accomplished by changing the shape of the guide railing, and on the shorter platform cars by moving the controller to the right, away from the entrance. (In the 100 class the latter is not necessary, since great improvement is possible by alteration of the guide railing alone.)

3. Inasmuch as the use of the prepayment fare box is established, end bulkheads should be removed to provide the additional entrance way made necessary by this method of fare collection (except in the 100 class, which already have a wide bulkhead opening). In this manner a "California" type car may readily be developed by locating the bulkheads within the car body, forming a closed central section with open end compartments.

4. If a fare box is to be used, the elimination of the end bulkhead is essential, but in this case moving the controller to the side, although desirable, will not be absolutely necessary. On the other hand, if the fare box is not used, it will be unnecessary to take out the end bulkhead, since moving the controller will provide considerable platform space. In any case, the clear entrance way to the car body should generally exceed 24 inches.

5. Lengthening of platforms is preferable if the cars are in sufficiently good condition to warrant the expenditure; but the change would not be worth while unless each platform could be lengthened at least 12 inches. If none of these improvements are carried out, the short platform cars should be retired to outlying or cross-town service, where traffic is lighter.

6. The closed section of the "California" type cars should have cross seats, but in the end compartments the maximum amount of storage space should be provided to accommodate short-haul riders. This necessitates the use of a longitudinal seat on that side of the car where passengers enter, as in the Geary Street design. In the all-enclosed box car, 100 class, at least 50% of the seating capacity should be in cross seats arranged as in the 1500 or 1550 types instead of the present all-longitudinal plan.

7. During stormy weather, protection by windows or curtains must be provided in the "California" type cars for passengers using the open sections, otherwise more than half of the seating capacity of the car is rendered unavailable at such times, when maximum capacity is demanded by the excessive rush hour loading.

8. In cars from which the end bulkheads are not removed, such as the 100 class, the stanchion in the middle of the door opening should be set out six or eight inches from the end sill to increase the entrance and exit passageways.

9. The "Cleveland" fare box frame as hereinafter described will provide the maximum storage space on short platform cars using this method of fare collection. If the fare box is not used, the present type of guide railing altered in shape, may be retained, but any rail of this type should be cut off at least 24 inches from the step or provided with the "Oakland" radius rod in order to make the entire step available for emergency loading.

10. Any form of guide railing or fare box stanchion should be movable, so as to be located behind the motorman on the forward end to protect him from interference by standing passengers during surges of the car, at the same time clearing the forward platform of obstructions.

11. Rapid unloading at the forward end should be facilitated by the following means: (a) Removal of the stanchions now dividing the door opening (unless bulkheads are removed) so as to give a less obstructed exit way; (b) moving the exit gate next to the bulkhead in order that passengers alighting will not have to force their way through a crowded platform. This will also have the effect of decreasing the necessary length of safety stations on the street; (c) providing a gate at least 30 inches wide and of a type such as a sliding gate, which does not interfere with passengers standing on the platform.

12. All cars should be provided with automatic folding steps at the forward exits, and lift steps at the rear entrances. With all steps raised except that under the conductor's control, accidents will be greatly reduced.

13. On the flush-platform "California" type cars (700 class) the principal improvements that should be made include the remodeled guide railing, storm curtains in the open sections, and a seating arrangement approximating the Municipal car plan, except that in such a narrow car two rows of cross seats should not be used in the closed section; also the projecting steps on these cars, or any other type, should be replaced by automatic folding steps to prevent accidents.

14. On the 1300 class, the platforms should be lengthened and the car converted into the prepayment type if it is to be operated on any important lines. The recommendations made for the 700 class will all apply.

15. Power brakes should be used on all double-truck equipment especially that operating within the congested districts. The

expense of new brake installation on cars that have been in service 10 years or more would not be warranted, but such equipment should be immediately retired to outlying districts.

16. Cable cars of the Powell Street lines should have additional capacity, and these short cars should be immediately converted into the "California" type by the addition of another open section. Double-end operation should be provided for, together with the removal of turntables, especially at the end of Powell Street. In the design of new cable equipment, the adoption of the prepayment center entrance type should receive serious consideration, with the object of reducing accidents and obstructions of streets.

17. For hill-top lines encountering long grades much in excess of 10 or 12%, a special type of car should be developed, of light construction and equipped with power track brakes such as the magnetic type; this car to be from 35 to 40 feet in length and seating about 36 people.

GENERAL DISCUSSION

The United Railroads at the present time operates on its various lines a total of 620 electric cars, which may be divided into four groups:

1. Modern cars either designed as or later converted into the prepayment type:

Class 1500-1549	50	closed body, drop platform.
Class 1550-1749	199	closed body, drop platform.
Class 101-180	80	closed body, drop platform.
Class 700-719	20	rebuilt "California" type, flush platform.
Total........	349	

2. Modern cars now operated non-prepay:
Class 1300-1425 123 "California" type, flush platform.

3. Various old types almost entirely obsolete, and nearly ready to be retired from service unless rebuilt.

Classes 500, 600, 700, 1000 and 1100—63 single-truck original "California" type cars.*

Classes 681-698,† 731-745, 1001-1024—55 double-truck original "California" type, flush platform.

Total 118

*These have been renumbered 601-663.
†Bodies may be rebuilt for prepay operation.

4. Interurban cars:

Class	1-12	12 closed 56-seat interurban cars.
Class	1225-1244	18 closed 48-seat-suburban cars.
Total.........		30

Of these four groups, only the first two, both of which are covered in Plate 12, will be dealt with in detail. The third group consists of cars which have been in service so long that extensive improvements in them would hardly be warranted, unless they be rebuilt. The cars listed under this head are operated at present on lines south of Market Street for the most part, and as fast as new rolling stock is added these should be retired to lines where the traffic is lighter.

Loading Time. The relatively slow loading of the various types of San Francisco cars has already been emphasized in the discussion of lower Market Street congestion and of service, and the results of several hundred observations are entirely consistent in showing that the attempt to apply the prepayment principle under the unusually severe loading conditions of San Francisco to a car with short platform and constricted entrance has not been a success. It is a fact that on cars of different platform length, the relative loading speed is practically proportional to the length of the available entrance step, until the platform storage space is entirely taken up, providing no further obstruction is interposed in the line of incoming passengers.

Under the loading conditions in Chicago, which are not more severe than the terminal and Market Street loading in San Francisco, a platform 8′ 4½″ in length was provided for a car body of about the same size as in this city, giving a clear entrance width of 40 inches. But with the abrupt vertical grades and necessary platform overhang in San Francisco, the present operating company has established a platform length somewhat shorter—7′ 4″ If this length were taken advantage of to the fullest extent, as has been done in the Municipal Railway car, it would be sufficient. A study of Fig. 29 has developed the following facts:

1. For loading conditions in San Francisco, sufficient storage space should be provided on the platform to accommodate an average group of 10 and a maximum of 25 passengers waiting to pay their fare.*

2. For average groups of 10 passengers, the loading time for the best of the San Francisco cars is 27.5% slower than the lat-

*The Municipal Railway cars are now carrying from 20 to 25 passengers on the rear platform.

est equipment operated in Oakland, and for the short platform types 65% slower, or twice as slow as the standard cars of Chicago.

3. In spite of its undoubted advantages, the introduction of fare box collection has resulted, with the same railing, in slowing up the loading materially. Even with properly shaped railings this would occur, principally due to the necessary reduction of storage space and entrance passageway (which are already too small on these cars), as well as to the delay incident to making change.

At terminals and heavy loading points it was recommended that the front exit, as well as the rear entrance gate, should be used for loading, with extra conductors stationed at these points to receive additional fares. This plan has been put into operation by the the United Railroads with very satisfactory results, and the total time of *terminal* loading has now been reduced to a point practically equivalent to that of the Chicago standard car loading along the street *by the usual rear entrance.*

Observations show, Fig 48 (b), that although the front gate requires 25% more time to load than the rear, the total loading is reduced to about *one second per passenger.* In other words, by this expedient the present short platform car has increased in loading speed by one-third.

However, for the average *street* loading conditions, the speed is necessarily slower, as shown by the dotted line, for the reason that passengers alighting at the rear end use part of the platform step, so that for equal conditions the San Francisco car loading at both ends is about one-third slower than the Chicago standard loading at the rear end only.

Thus far the results of the new Municipal car indicate that the principles herein expressed are correct, and that by the provision of ample storage space the loading speed of these cars under normal conditions will probably approximate that of the long platform cars used in Chicago.

GROUP I—PREPAYMENT.

Class 1500 (1500-1549), Plate 12(B)

These so-called "Chicago"† cars, 50 in number, are a closed body, 44-seat, prepay car weighing 52,000 pounds, built by the American Car Company and purchased from the Chicago City Railway Company in 1906. The body is 32′ 4″ long—practically

†This is an entirely different car from the standard developed by the Board of Supervising Engineers, Chicago Traction, which is only 8 ft. 6 in. wide and designed for 10 ft. 2 in. track centers.

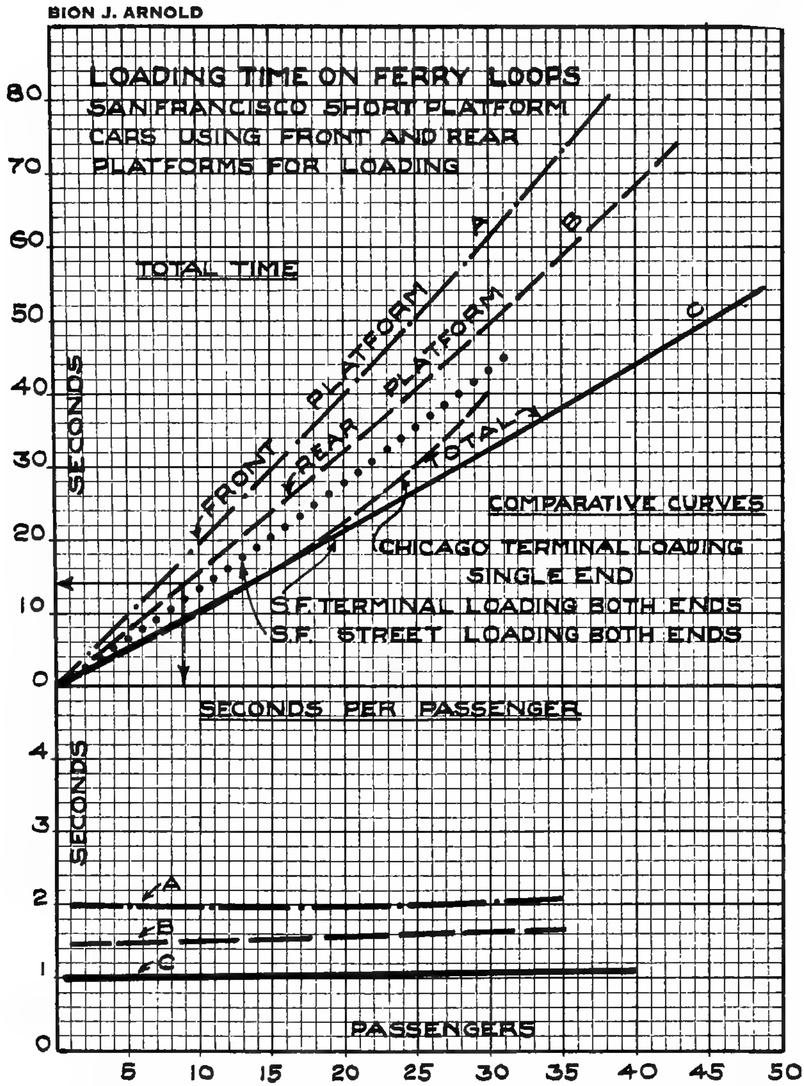


FIGURE 48b—TERMINAL LOADING TIME, FRONT AND REAR.

Upon the loading speed of platforms depends to a large degree the capacity of the line in periods of heaviest traffic. These curves are representative of 75% of the large cars operated here, and show the total time of loading, and the time per passenger required for various groups boarding at the Ferry terminal by both front and rear platforms. Curves A, B and C are from actual observation, and do not necessarily sum up. The fact that the loading speed of the San Francisco cars, using *both* platforms, is barely equal to those in Chicago using the *rear* platform only, indicates the need of rearrangement of fixtures to obtain much faster loading along the street.

the same as the Municipal car—but 9′ 2″ wide. The platforms are only 6′ 8½″ long from sill to bumper, and are slightly tapered.

The cars were originally designed for non-prepay operation, and were consequently provided with comparatively short platforms. When they were converted to the prepay type, the platforms were not lengthened, resulting in a constricted entrance which is the cause of most of the present difficulty in their operation. In the rebuilding of this same car in Chicago, platforms were lengthened to over 8 feet and further tapered to enable cars to pass on curves.

Platform Arrangement. The most obvious remedy for the loading difficulties in this 1500 class is to lengthen the platforms, and this should be done if it is found that the age and condition of the cars warrant the considerable expenditure incident to such an alteration; otherwise they should be kept out of the congested district.

In any case, whether or not it is considered expedient to make this change, the present platform equipment should be re-arranged so as to provide the maximum storage space for entering passengers, at the point where it is most desirable, viz.: opposite the entrance. The present constricted entrance is due to two defects—the shape of the guide rail, and the position and type of the controller.

The *clear* space of 24½″ provided at the step is almost immediately contracted upon entering the platform to 20½″ between the controller and the guide rail. This space is totally inadequate for loading any considerable groups of passengers, as it provides practically no storage space on the platform where most needed—*i. e.*, for passengers waiting to pay their fare. Consequently, the passengers are forced to enter in single file, and it is necessary for the car to remain at a full stop until all but the last three or four passengers have paid their fare.

There are two ways of improving this situation:

(1) By flattening the guide rail and by moving the step stanchion so as to divide the step width into a 26-inch entrance and 23-inch exit space.

(2) By locating the controller and motorman's stand at the right-hand side of the vestibule.

These improvements provide the best arrangement possible with the present platforms, by eliminating entirely the narrow throat in the entrance passage and giving ample storage space.

In general it appears that the logical place for the motorman's stand in a short platform prepayment car is at the side if a type K controller is used. The shorter the platform, the more desirable

does this position become. This arrangement is objected to on the ground that the motorman will be unable to watch vehicle clearance as well from the side as he can from his present position. While unquestionably true regarding vehicles on the left-hand side of the car, he will have a better view of those on the right-hand roadway, where the majority are to be found in accordance with police regulations.

Guide Rail. In order to accommodate exceptionally large groups of passengers, such as are encountered at the Ferry terminal, it is desirable to make use of the entire 46 inches of clear step width for entrance. The United Railroads has sought to accomplish this result on its later cars by cutting off the guide rail about 17 inches back from the step stanchion. This is a great improvement over the former design, but to realize the full benefit of the step width this distance should be at least 24 inches.

Another method of accomplishing the same result is by the employment of a radius rod similar to the one used at present in Oakland. This provides a means of closing the rear exit if necessary, and at the same time forms a guide rail for all passengers entering.

Bulkhead Opening. The bulkhead or entrance door opening on the 1500 class car is 40 inches wide, which provides only 20-inch exit and entrance spaces. The use of a fare box still further reduces the rear exit space to 18 inches. Since a single file of passengers past the fare box is desirable, this condition is most serious due to the constricted exit space which greatly retards unloading from the forward end.

These passageways should be increased by the removal of the bulkheads from the end to the inside of the car body, thus dividing it into a middle closed section and two open end sections as in the Municipal car. With the windows dropped in the end sections, this would provide practically a "California" type car, which is very desirable for the San Francisco climate. The windows would then be available for storm protection.

If the present bulkheads are removed and it is desirable to use a fare box on the short platform cars, probably the best arrangement of platform equipment is to place the fare box directly behind the stanchion with the conductor standing between, as shown in Plate 12. This arrangement is in use at present in Cleveland on long platform cars, and makes available for storage space more of the platform area than any other type of railing in use.*

*This Cleveland arrangement consists of a three-sided railing just large enough to surround the fare box at a height sufficient to afford a convenient grab handle. Preferably, it should be jointed so that it may be conveniently straightened and set into floor sockets behind the motorman for his protection as in the other types of movable railing suggested herein.

Unloading. For obvious reasons, it is desirable that unloading be done as speedily as possible, and that passengers be encouraged to use the forward exit. To this end all possible obstructions in the exit passageway should be removed. The comparatively long time required to unload these cars at present (often as much as 1½ seconds per passenger) is due to three conditions:

1st. The division of the door opening by a fixed stanchion usually results in the use of only one-half of the available width —*i. e.,* 20 inches in this car.

2nd. After reaching the platform, passengers usually have to force their way through groups standing on the platform to reach the forward exit gate.

3rd. The width of the exit gate opening—only 24 inches—is insufficient for passengers alighting in groups.

The first defect may be remedied by the removal of the end bulkheads as previously recommended, or by the substitution of a short movable stanchion for the present fixed stanchion running from floor to roof, which will entirely clear the door opening at the forward end of the car.

The second defect is due to the position of the forward exit gate next to the bumper. This gate should be placed next to the bulkhead as in the Municipal and Oakland cars, in which position the obstruction of the main exit passageway would be largely removed. Objection may be made to such a position of the exit gate on the ground that the motorman cannot watch the steps as easily as at present, thus increasing the possibility of accidents. On the contrary, the very fact that the motorman must turn to watch the gate affords additional security that he will not start the car until the gate is cleared.

An additional necessity for the location of the front exit gate next to the bulkhead arises from the fact that the length of the safety stations along Market Street may be reduced 2½ to 3 feet, with a corresponding reduction in the obstruction of the street by these long platforms. This is critical at Lotta's Fountain, where a two-car station is absolutely essential. Here, in order to avoid interfering with intersecting lines of vehicle traffic, the length of the station is limited by the curb lines to 96 feet, which will just suffice with the proposed location of the exit gate.

The present exit gate is as wide as it is possible to make a single-leaf sliding gate on a platform such as provided in the 1500 class. But this exit opening should be widened at least to 30 inches by the use of a folding gate, or a two-leaf sliding gate. This is particularly necessary at the Ferry and other terminals where it is desir-

able that cars be able to load and unload simultaneously at each end. The method recommended of opening the forward left-hand pantagraph gate full width for exit is as applicable to the present rolling stock as to the proposed new car.

Seating Arrangement. The seating arrangement in these cars is the best to be found in any of the United Railroads rolling stock and conforms closely to that of the standard car now used in Chicago. If the bulkheads are removed to the inside as recommended, either the present seating arrangement may be retained or that of the Municipal car may be used, with the result shown in Plate 12.

Class 1550 (1550-1749), Plate 12(C)

These 200 cars were purchased from the St. Louis Car Company in 1907, and are in operation at the present time over many of the most important lines in the city. They are of the same type and have the same general dimensions as the 1500 class, excepting that the platforms are tapered and are still shorter—only 6′ 6″ over all.

The platform arrangement is practically identical with the 1500 class, and is of course open to the same objections. All of the improvements suggested for the former type apply equally well to the 1550 class. However, the narrow side window in the vestibule of these cars will have to be widened if the controller is moved to the side. The extra cost of the alteration makes it more desirable to remove the end bulkhead, but if this latter change is not made, the controller should be moved.

The general seating plan adopted in the latest of the 1550 class cars is good, except that the cross seats provide only 36% of the total, as compared with 73% in the Municipal car, and 64% in the 1500 class. More cross seats were not put in on the ground that it would constrict the aisle at the center of the car. However, in view of the fact that a still narrower aisle is at present in successful use in the city of Chicago, it does not appear that much trouble would be encountered from this source. Therefore, at least half of the total should be in cross seats.

The last of the cars converted to the prepay type have the longitudinal seat placed opposite the entrance space, which is good design, and it is understood that all remaining cars will be rearranged in this manner during the annual overhauling.

New Car Bodies. The above recommendations will apply if the car is to be operated in its present form. All of these cars, however, are about 10,000 lbs. heavier than the more modern equip-

ment now on order, and it may be that the saving in power and maintenance resulting from the use of a lighter car will justify replacing the present bodies, since the trucks, motors, and control are in good condition. In any event, these heavy cars should only be used on the most level routes.

RELATIVE WEIGHTS OF EQUIPMENT

	Seating Capacity* Total	Weight Equipped	Weight per Seat
Prepay Electric—			
Geary St.—"California"	48	48,000	1000
101-180 —Closed	44	46,000	1045
1500-1549—Closed	44	52,000	1180
1550-1749—Closed	44	56,000	1270
700-1719 —"California	43	38,000	884
Non-prepay Electric—			
600-663 —Original "California," single truck	28	14,000	500
681-698 —Original "California"	44	38,000	864
731-745 —Original "California"	40	33,000	825
1001-1024—Original "California"	42	32,000	762
1300-1425—"California"	40	40,000	1000
Interurban—			
1-12 —Closed	56	80,000	1430
1225-1244—Closed	48	52,000	1080
Cable—			
Powell Street—Half open, half closed	29	12,000	414
Sacramento Street—"California"	36	14,000	389
California Street—"California"	34	11,200	324

Class 100 (101-180) Plate 12(A)

These 80 cars are of the closed body, 44-seat, prepayment type purchased in 1911, having approximately the same body dimensions as the two types previously discussed, and weighing 46,000 pounds. They have 7′ 4″ tapered platforms, being, with the exception of a few rebuilt cars, the only ones owned by the United Railroads *originally designed for prepayment operation.*

The platform congestion in these cars may be relieved by adopting several of the suggestions made for the previous types. Although moving the controller is desirable, it is not so necessary in this type since an increase in the passage width of fully 35% may be obtained by altering the guide rail alone, or using the "Cleveland" rail.

The seats provided on this class are entirely longitudinal, a type which seems hardly justified in so wide a car (9′ 2″) since ample aisle space can be secured with cross seats. At best, longitudinal seats are too unpopular to encourage riding, and should be

* On basis of 17 inches per passenger for longitudinal seats.

avoided if possible—particularly in cars which operate over severe grades. The seating arrangement should be altered so as to approximate either the Municipal, 1500 or 1550 class layout, with at least 50% cross seats.

The type of exit gate used, while closing flat, unfortunately takes up considerable platform space when opened, very often striking passengers waiting to get off. It should be altered so as to remove this defect, or, preferably, should be replaced by a sliding gate, since the platforms are long enough to permit a fairly large exit opening. In either case, this gate should be placed next to the bulkhead.

Class 700 (700-719)

The cars of this class, 20 in number, are of the "California" prepayment type, with flush or continuous platforms. They were rebuilt by the United Railroads, from former cable car underframing. These cars are only 8′ 2″ wide—the narrowest of all the prepay equipment operated in the city. Cross seats are used, nevertheless.

While ample space is provided on the platforms, the entrance passage is reduced from 34 inches at the step to 24 inches at the controller due to the shape of the guide rail. By flattening this rail, a uniform entrance width of 34 inches may be obtained, and still leave sufficient room for an exit passageway and for the conductor.

The seating arrangement is much the same as is proposed for the United Railroads' new car, and is open to the same objections*, which, however, are much more pronounced here on account of being applied to a narrower car. If any more of these cars are built, the seating plan should provide half cross seats on the *inside* section. And the open sections should be arranged similar to the Municipal cars to afford greater storage space opposite the entrance.

The type of compressor used is not well adapted for suspension beneath the car floor, and in the position shown, Plate 12 (F), the least obstruction to much-needed floor space will result, since sand boxes should be located so as not to consume valuable storage space at the entrance step, as at present.

There is now no protection for passengers on the outside sections during inclement weather. As in the other "California" type cars, windows or storm curtains are necessary in the open sections.

The steps on the 700 class project 8½ inches beyond the car body, resulting in an over-all width of 9′ 7″, exceeding the largest

*Discussed in the preceding chapter.

car body. They should be changed to the automatic folding type if the cars are to be run along business streets, but in any case, the projecting steps are most undesirable as they are a fruitful source of accidents.

GROUP II—NON-PREPAY

Class 1300 (1300-1424), Plate 12(F)

These cars, 123 in number, are of the "California" flush platform type with entrances located next to the closed compartment. They were purchased in 1903 and 1904 from the St. Louis Car Company. As at present arranged, they are not adapted to the short-haul riding found in San Francisco, since very limited platform storage space is provided. Consequently, passengers stand directly in the entrance and exit passageway, necessarily resulting in very slow loading and unloading. Further, the motorman cannot watch the exit easily, which is more important in a non-prepayment than in a prepayment car, where a closed gate protects the exit.

It is desirable that these cars be converted into the prepay type.* This may be done without altering the body under-framing, but preferably by extending each platform two or three feet and changing the steps to the forward position. The recommendations for the 700 class apply equally to this 1300 class.

Union Street Cars

The present cars of the Union Street line are entirely inadequate for proper service on any important thoroughfare or trunk line. They are of the same type as the single-truck cars operated on the less important lines of the United Railroads, such as Sixth and Sansome, Visitacion Valley, etc. The principal deficiency is in motor capacity, which makes it necessary to ascend the long grades on the series position of the controller, resulting in an average speed of only 6.9 miles per hour.

If the recommended extensions are constructed, it will be possible to operate standard Municipal Railway equipment on the low-level sections of this Union Street line via Steiner and Greenwich Streets, in addition to hill service over the present route.

In any event, it will probably be desirable to design a special double-truck car of the "California" type for hill-top service throughout the city on such lines as Union Street, comprising the

*It is understood that this reconstruction is already under consideration.

lightest possible construction and ample motor and brake capacity. Such a departure from the standard type adopted for the remainder of the city is believed to be unavoidable.

Owing to the extreme grades and the sharp vertical curves encountered on the Union Street line, it is probable that a car from 35 to 40 feet in length, seating about 36 passengers, would be most suitable.

Cable Cars

The "California" type cars now operated on the Sacramento and Castro Street lines are comparatively satisfactory in general arrangement, although their weight—14,000 pounds—is rather high for cable equipment. On the other hand, the cars used on the Powell Street route, carrying a heavier traffic than any other cable line in the city, are the smallest on the system, and are totally inadequate for the traffic. The Powell Street cars should be changed at once to the "California" type similar to that used on California and Sacramento Streets, and should be equipped for double end operation, thus eliminating the turn-tables, especially that on Powell Street, which constitutes an unwarranted obstruction to traffic on a very important thoroughfare already too narrow.

These changes will necessitate the addition of a second open section, and possibly the shortening of the present one in order to keep the length and weight of the car within reasonable limits. It is essential that there be an entrance on each side of the car at either end, and these passageways should be at least 24 inches wide instead of the single 18-inch space now provided on the open end of the present Powell Street car. Also the clear width of door openings in the closed section should be increased from 20 inches, as at present, to at least 26 inches.

The general design of the car operated by the California Street Cable Railway seems to be well suited to conditions in San Francisco, especially in the matter of weight—11,000 lbs.—which probably represents the minimum for a car of this size.

It is possible by the adoption of the center entrance plan, to produce a prepayment cable car. In this case the gripman will have to be placed on the side and the grip operated by rods in some such manner as in the present California Street cars. Present indications are that cable traction will remain a necessity on the heavier grades of San Francisco hill lines, and an effort should therefore be made to perfect such a design for future cable equipment. But it should be stated that as a cable car can only operate at a fixed maximum speed, and thus cannot make up much lost time, the delays resulting from the prepay plan may

become serious unless especially large storage capacity be made available at the entrances. There is no doubt that the original "California" type car can load faster than any other now used in San Francisco.

Brake Equipment

The subject of brake equipment is one receiving attention in all large cities, and widely diverse opinions are held as to the proper type of brakes for various classes of rolling stock.

In San Francisco, air brake equipment is used on all electric cars with the exception of 39 double-truck and 63 single-truck cars of the original "California" type. This does not include the cable cars, all of which are equipped with hand wheel and track brakes. Of the equipment now controlled by hand brakes, the double-truck cars weigh from 32,000 to 34,000 pounds equipped, but without passenger load; and the single-truck types weigh about 14,000 pounds equipped; double-truck cars operated by air brakes, from 38,000 to 80,000 pounds, equipped. In analyzing the accident account of street railways operating hand and air brake cars in some of the large cities of the country, it appears that there is a more or less clearly defined line which constitutes a practical limit for the operation of these two types of brake equipment, and there are involved the factors of type and weight of car, scheduled speed, character of territory traversed, kind of street traffic encountered, prevalence of bad rail conditions, etc., so that it is impossible to establish a definite limit for universal application. The standard "Chicago" car with air brake equipment is able to stop within a distance of 145 feet, under maximum brake application when running at maximum speed—about 24 miles per hour.

Comparative braking tests in New York City, made upon a car weighing 38,000 pounds, and running at a speed of about 17 miles an hour, showed an average braking distance of 114.2 feet for air brakes, and 141.6 for hand brakes. The minimum distance observed was 105 feet for air, and 128 feet for hand brakes. This means that the air brakes stop the car within 2.8 lengths, and hand brakes within 3.5 lengths. Recent discussion of this subject resulted in an order issued by the Public Service Commission of the First District to equip all double-truck surface passenger cars weighing over 37,000 lbs. with power brakes and geared hand brakes, which order was further modified with the intention that in the future all new equipment should be furnished with both power and hand brakes. This order undoubtedly contemplated the exclusive installation of double-truck cars operating within the city.

In San Francisco, those cars which are not equipped with power brakes have two types of lever hand brakes: (1) wheel brake, (2) track brake. The track brake undoubtedly gives additional security over the ordinary hand wheel brake. Moreover, the hand brake cars are of the older styles, and will unquestionably be retired in the near future. Consequently, it is not a justifiable expense to equip all of these older cars with air brakes. If any line may be drawn, I would recommend that the single-truck cars be allowed to run with their present brake equipment and also any double-truck cars now in service that have had more than ten years' wear.

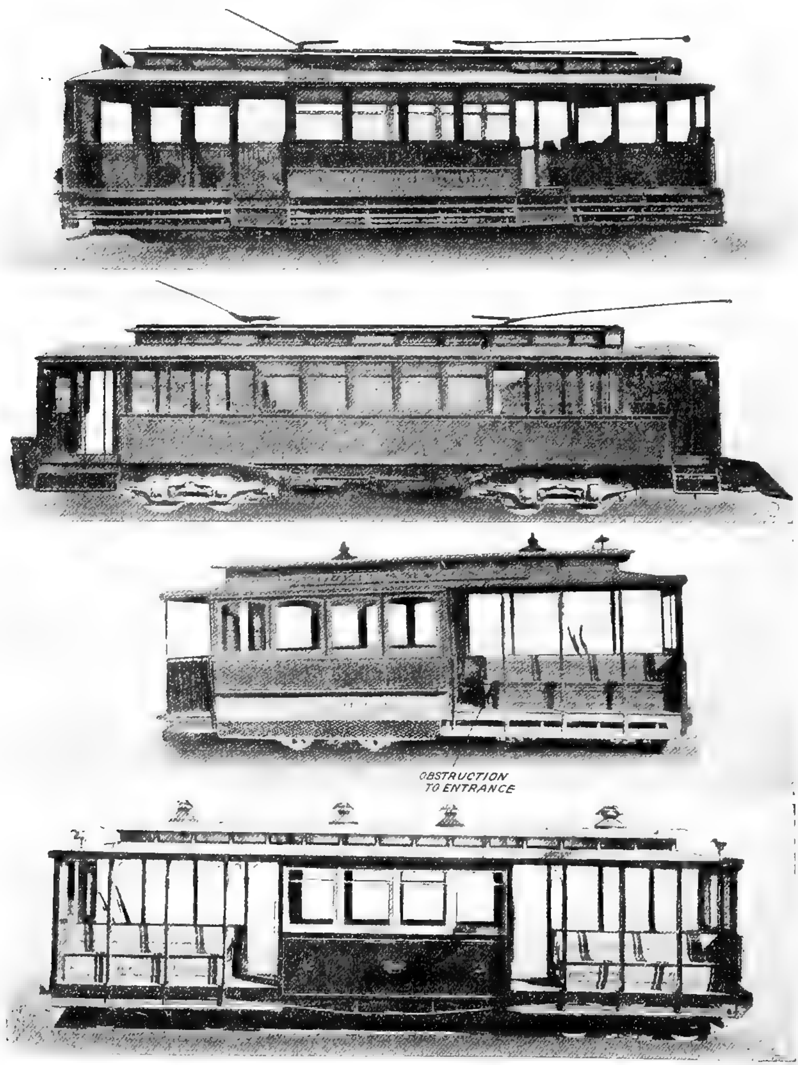
All of these cars, however, should be kept off of the principal thoroughfares and should be used on the outlying lines, where the density of the street traffic is a minimum. I understand the practice of the operating company is to use power brakes on all cars over 33,000 lbs. in weight, equipped, which is satisfactory. If, however, it is determined to operate any new double-truck cars of lighter weight, I should still recommend that power brakes be used.

Track Brakes. For so-called hill lines, where the necessities of routing require operation over grade much in excess of 10 to 12%, I believe that it would be hazardous to attempt to operate a fast schedule without the assistance of some form of power track brake, especially for a large car of 40 seats or more which will probably weigh in excess of 40,000 lbs. Although it is true that in San Francisco, climatic conditions are such that a clean rail is usually available, on which air brakes would be safe, yet the occasional occurrence of slippery rail and the danger of over-running stops through too rapid coasting down grade invites serious accidents.

The magnetic track brake has been developed for meeting just such conditions, and I should recommend that careful study be given to this form of equipment with a view of applying it to these hill lines, as it has been successfully applied in other cities—Los Angeles, Portland, and Seattle—with grades as high as 14% and standard heavy cars. Although this brake equipment now includes a separate controller on the platform, it is believed that this could be modified by locating the brake controller beneath the platform or car body in order to clear the platform of the additional obstruction which would arise from having two controllers.

This magnetic track brake, with its latest improvements, undoubtedly offers greater security than it is possible to obtain with any other kind of brake equipment at present manufactured, for

the reason that the retarding force is applied not only to the wheels but also to the motors, and especially to the rail surface; so that the danger of skidding in making a quick stop is thus minimized. It is possible, with this equipment, on a level track to stop a heavy modern car running at full speed, 21 miles per hour, practically within its own length—*i. e.*, within less than 50 feet. This is far beyond the limits of the usual air brake equipment.



POSSIBLE CAR RECONSTRUCTION.

(1)—1300-1425 class; (2)—lengthened and changed to prepayment type. (3)—Powell Street cars; (4)—lengthened and changed to the double-end, Clay Street type.

PART IV

SUPPLEMENTAL IMPROVEMENTS IN CITY PLAN

CHAPTER 10

TUNNELS INTO HARBOR VIEW†

Projects Investigated*

Tunnel under Fort Mason.

Stockton Street tunnel.	**Steiner Street tunnel.**
Broadway tunnel.	**Pierce Street tunnel.**
Fillmore Street tunnel.	**Divisadero Street tunnel**

Diagonal tunnel from Union Square to Harbor View.

The steep hills of San Francisco in so many cases render electric railway operation impracticable in the absence of contour streets, that the many intervening valleys are often practically inaccessible without tunnels, resulting in large areas remaining undeveloped, although close to the center of the city. Of these tracts one of the largest is Harbor View, and the building of such tunnels is made particularly urgent in order to serve the heavy traffic to the Panama-Pacific Exposition. In this chapter are discussed the various tunnel routes that have been suggested, also new ones, with final recommendations thereon. However, in recommending the immediate construction of certain of these tunnels, it has been considered that the large investment necessary would not be justified for the Exposition traffic alone, but that they should also be in a logical position for facilitating the future development of the city.

CONCLUSIONS AND RECOMMENDATIONS

1. The success of the Panama-Pacific International Exposition largely depends upon securing suitable entrances into Harbor View for transporting both passengers and freight to the Exposition grounds.

2. A tunnel under Fort Mason should be built so as to make it practicable to extend the railroad now on Beach Street on a low grade, practicable for the operation of steam railroad traffic as well as heavy trucking and street railway cars. As an alternative, a diagonal alignment from Jefferson Street on the east to Beach Street on the west may be substituted to avoid the legal obstacles to the use of Beach Street between Polk Street and Van Ness Avenue now partly occupied by the Spring Valley Water Company. If this tunnel is constructed immediately, it will be available for con-

†Formerly Preliminary Reports Nos. 2 and 3, submitted Feb. 9th, and March 29th, 1913.

*This list includes Harbor View projects only. Additional tunnel projects are discussed in Chapters 11 and 12.

veying to the Exposition grounds much of the material to be used in the construction of many of the buildings and exhibits, and will also make it possible to greatly reduce the cost of hauling freight by teams into these grounds.

3. The construction of the Stockton Street tunnel from Sutter to Sacramento Streets should be begun at once so that it may be available for team and street railway traffic via Stockton Street, Columbus Avenue, and the Fort Mason tunnel or North Point Street to the Exposition grounds.

4. The Broadway tunnel from Mason to Larkin Streets should also be constructed at the earliest practicable date, as a project supplemental to the Stockton Street tunnel for routing cars more directly from both the business center and from the Ferry to Harbor View.

5. Considering no changes in the elevations of present street intersections, the Fillmore Street tunnel should be built immediately, extending from Sutter Street to Filbert Street, with the necessary street-widening at portals to preserve the roadways at either side for street-cars, traffic, and sidewalks.

6. It is not advisable to undertake at the present time the construction of more than one tunnel through the Pacific Heights ridge, either for traffic necessities during the Exposition or immediately thereafter. A tunnel through Divisadero Street, with portals so located as to provide a high-level route, may become a future necessity if the Harbor View valley develops into a commercial district after the close of the Exposition. Regarding the development of commercial interests on these parallel streets (Fillmore and Divisadero Streets), these two tunnel projects should not be considered *competitive*, but rather *coincidental.*

7. For a low-grade traffic and railway tunnel, Pierce Street is impracticable as a possible tunnel site, not only because its approach grades are almost prohibitive for the purpose immediately in view, but also for the reason that a tunnel through Pierce Street would effectually block for many years to come a consideration of the two tunnels ultimately needed—Fillmore and Divisadero Streets—because of their proximity. It is therefore better, in my judgment, to follow a logical program of development, than to compromise both projects in the interests only of the very immediate future.

GENERAL DISCUSSION

In these studies, all projects have been rejected that would not provide the thing most needed—one direct, low-level and low-grade traffic route from the Mission to Harbor View—which could be used for transporting the heavier materials to the Harbor View

site with its possible future development as a warehouse and manufacturing district. None of the high-level tunnels will permit of approach grades under 5%, although entirely suitable for street railway and lighter vehicle traffic only. Whatever the ultimate character of the development of the Harbor View district, *at least one low-level route* is absolutely essential, and therefore the Fillmore Street tunnel has been adopted in spite of its length. All of the Harbor View tunnels are long if planned as low-level projects, and in view of this fact, a difference in length of two blocks either way does not seem to me a determining factor as between locations.

Type of Bore. The question of type of tunnel—whether single-bore, double-bore, or individual bores for traffic and railway—should be determined on a basis of convenience and cost. As all of these tunnels paralleling Fillmore Street are intended for high-speed operation, the tracks must be separated from the roadway; consequently, if double-bore, considerable expense can be saved, particularly over the cost of independent bores, by driving both bores at once.

A route has been sought whereby a *short* low-level and low-grade traffic tunnel could be secured *independent* of the railway tunnel, but the northerly approach grades prohibit; consequently I favor a combined tunnel, whether single or double-bore being immaterial. A single-bore tunnel would be more attractive on account of its roomier appearance, especially in so long a bore, but the roadway and trackway would be cramped by the addition of one sidewalk not absolutely required. The double-bore tunnel has the advantage of a larger roadway, and the disadvantage of slightly higher cost. In both arrangements, teams should be separated from foot passengers, which is in some respects desirable. And this disposition of the double-bore involves less unbalancing of the arch and consequently lower cost, than will be the case if roadway and sidewalk occupy the same bore, necessitating spans of 32 and 22 feet, as against spans of 25 and 29 feet, respectively. (Fig. 49.)

Walkways. Considering various arrangements of roadway, trackway, and sidewalks, I have concluded that it becomes practically imperative to locate the sidewalk adjacent to the partition wall, with arch openings spaced every 75 or 100 feet communicating between the two bores. This communication is necessary to provide means of egress from the long bores in case of urgent necessity either from vehicles or from cars. This arrangement has the slight disadvantage of requiring foot passengers to cross the tracks at either portal, but I do not consider this serious, on account of the fact that the walkway will probably not be used to any great extent. One sidewalk will suffice for the long tunnel, in my judgment, and the

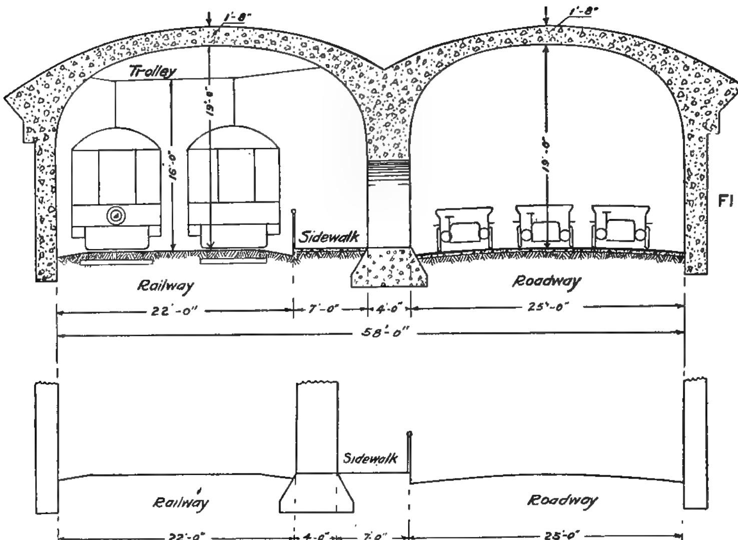


FIG. 49

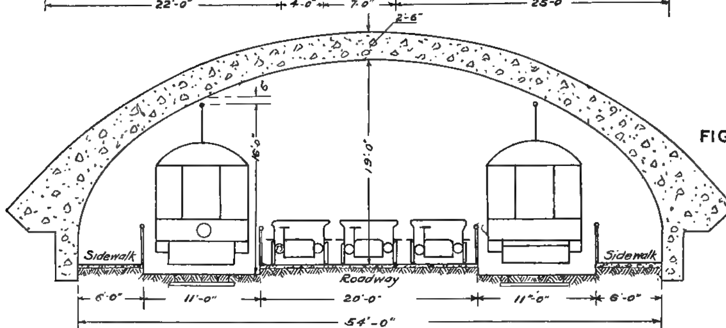


FIG. 50

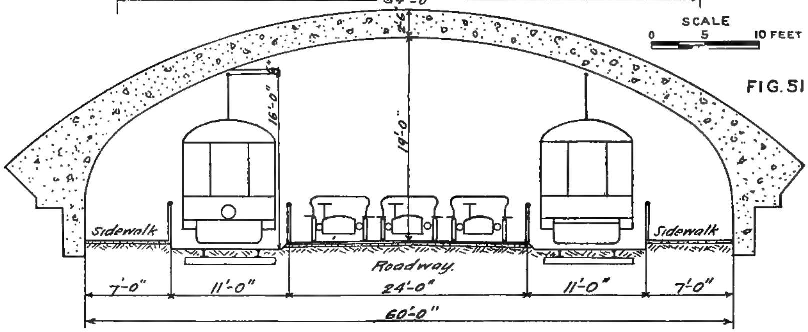


FIG. 51

FIGURES 49, 50 AND 51—SECTIONS OF TUNNELS TO HARBOR VIEW.

Figure 49. Section recommended for Fillmore Street tunnel, completely segregating vehicle and railway traffic, thus permitting high speed operation, with alternative plans for foot-passageways using either bore.

Figure 50. Single-bore section for Fillmore Street tunnel, with various classes of traffic separated only by railings. The limitations of a 20-foot roadway for three lines of vehicles are evident.

Figure 51. Single-bore arrangement for Divisadero Street and Broadway tunnels. This section, being six feet wider, permits more sidewalk space, and ample room for three lines of vehicles in the center roadway.

only reason for providing a second one in the single-bore arch is to utilize the waste space near the wall to the best advantage.

Roadways. As one of the primary conditions in selecting this first tunnel route to Harbor View is to provide a low-level and low-grade route for heavy trucking, vertical clearance must be sufficient to accommodate vehicles loading up to a height of 12 to 15 feet. This manifestly precludes any arrangement but a central roadway, which divides the arch as follows:

Fillmore Street, center roadway,	20 ft.
Street cars, 11 ft. along each curb,	22 ft.*
Sidewalks, 6 ft. along each curb,	12 ft.
Total,	54 ft.

In concluding upon a minimum roadway width of 20 to 22 feet, the following principle has governed, viz.: to provide for two-line traffic for the wider and heavier vehicles, and three-line traffic for the narrower and lighter vehicles, such as automobiles. Trucks require nine feet, or at least ten feet to pass. Automobiles and light delivery wagons, whose wheel gauge approximates that of the street railway tracks, require about 6½ or 7½ feet to pass. This roadway of 22 feet therefore will enable either heavy or light vehicles to pass in the tunnel, or a third line of light vehicles to pass through the center, going in either direction, which latter will be the most necessary requirement.

In the double-bore arrangement, however, some increased width may be rendered available for the roadway by sacrificing one sidewalk and devoting one bore to a roadway 25 feet in width, and the other to trolley cars and a 7-foot sidewalk.

Special Work. The arrangement of track special work at the southern portal is unfortunately somewhat complicated, but as it is probable that all cars entering the tunnel will do so directly north on Fillmore (via Ellis-O'Farrell, not via Sutter), the worst pair of curves is eliminated. It will be desirable to set back the portal wall about 25 ft. north of the Sutter Street building-line, in order to permit the best arrangement of this special work.

Regrading. By a considerable amount of regrading of entrance and lateral thoroughfares in the vicinity of these various tunnel portals, it would be possible to considerably ease the grades and shorten all of these tunnels, thereby making them more con-

*Footnote—The above is based upon a street car width of 9 ft. over-all, corresponding to a trackway of 11 ft., but it is probable that in the future, the width of street cars operating through this tunnel will be limited to 8 ft. 6 in., and by reducing the side clearance to the very minimum, a trackway of 10 ft. could be used, giving a roadway of 22 ft., instead of 20 ft. This, however, is the maximum roadway that can be obtained in the single-bore arch, and provides extremely small clearance margins, in fact so small as to render the use of the single-bore extremely questionable.

venient and desirable. This, however, involves a large amount of damages. The total cost of the tunnel could not be materially reduced by such regrading; rather, it might be increased in some cases, and the delays incident thereto would probably make the proposition infeasible at the present time at least for Exposition purposes. In order to save one block in tunnel length, from five to ten blocks of main and lateral streets would have to be regraded, if any reasonable traffic grade were to result. The limit of this traffic grade for tunnel approaches I have placed at 4% maximum—better, 3%—and most of these regrades require prohibitive cuts, from the standpoint of damage to present abutting property.

Broadway Tunnel. The westerly portal of the Broadway tunnel should be located at Larkin Street rather than to attempt a location at Hyde Street, which latter exit would require regrading of Broadway and the lateral streets in order to reduce a prohibitive grade at this point. Furthermore, the exit at Larkin Street is well suited for a connection with future tracks along Larkin, either with those now occupied by the Union Street line or with future tracks through the Van Ness valley, connecting with the Geary Street or other lines.

The Broadway tunnel is not a *low-level* tunnel, by reason of the grades encountered on the easterly slopes; however, it can be considered an important traffic thoroughfare to Harbor View both from Stockton Street and The Embarcadero, supplementing the best low-level route, viz.: the freight and traffic tunnel under Fort Mason. The Broadway route entails a maximum grade of 6.3 per cent on the east, and 5.5 per cent on the west slope via Broadway, Polk, Vallejo, and Van Ness, and is therefore available for the majority of the lighter vehicle traffic. Practically nothing can be accomplished to relieve these controlling grades except by prohibitive regrading.

The particular section desirable for the Broadway tunnel depends upon the character of traffic. For a high-level tunnel, it is to be assumed that the heavier and larger vehicles will not ordinarily use the tunnel to any great extent; consequently, a narrower roadway is permissible than in the low-level for Fillmore Street bore. Owing to the greater width of Broadway, it would seem desirable to use the entire width of the street for the bore; which is one of the arguments for the location of a tunnel through Russian Hill in Broadway rather than some parallel street. A 60-ft. single-bore arch would provide a 24-ft. center roadway, which is ample for 3-line vehicle traffic; cars and sidewalks would be located along the walls. A 54-ft. single-bore arch would provide a 20-ft. center roadway, which is ample for 2-line vehicle traffic. If the car tracks

were located in the center of the tunnel, it would be impracticable to enclose them by fences. The width of roadway available along the sides would be 13½ ft. for the 60-ft. bore, and 11½ ft. for the 54-ft. bore. Both would provide for single-line traffic only.

The Stockton Street bore, as projected, is only 50 ft. wide, which allows only 8½ ft. roadway on either side of the car line—just sufficient for moderately large vehicles.

It may be reasoned that the same arrangement of tracks in the Broadway tunnel should be utilized as in the Stockton Street tunnel. However, the Stockton Street tunnel, including entrance grades, is 1322 ft. in length with 36-ft. roadway, while the Broadway tunnel is 2338 ft. in length—not far from double. This fact makes it desirable, in the interests of rapid transit, to separate the lines of traffic with fences as in the Fillmore Street scheme, and provide a roadway in the center.

Unit Estimates. The following estimates for the various types of tunnels have been submitted by the City Engineer, as suited to prices and conditions prevailing in San Francisco. In this comparison, the general design conforms to that of the Stockton Street tunnel, giving 19 ft. clear from street to arch, inside.

These estimates are necessarily liberal and include percentage allowances as follows: construction profit, 15%; contingencies, 10%. These are based on the following unit prices:

Excavation, heading	$ 5.00	per yard
" side-cut	3.00	" "
" bench	2.00	" "
Concrete, in place	10.00	" "
Re-enforcing steel, in place	70.00	" ton
Wages, 8-hour shifts	$3.00 to 6.00	" day
Teams	6.50	" day
Single-bore tunnel, 54 ft. wide, excluding approaches	428.00	per foot
Double-bore tunnel, 54 ft. net, excluding approaches	464.00	" "
Approaches	70.00	" "
Two individual bores on different streets, each 32-ft. span	494.00	" "
Single-bore, 60 ft. wide, excluding approaches	464.00	" "
Double-bore, 60 ft. net, excluding approaches	496.00	" "
Approaches	80.00	" "

From these estimates it appears that the double-bore tunnel will cost somewhat more than the single-bore—about 9%—and that the cost of the wider single bore tunnel is 7 to 8% higher than the narrower section.

The resulting total costs on this basis are as follows (exclusive of damages and enlargement of approaches). They are, in fact, higher than the Stockton Street tunnel estimates, but this is largely owing to the great length of the tunnels and the increased difficulty of prosecuting the work.

Low Level	Bore	Length	Single Bore	Double Bore
Fillmore—Sutter to Filbert.........	54′	4332′	$1,685,800	$1,824,900
Steiner—Pine to Union............	54′	3301′	1,237,400	1,338,600
Divisadero—Pine to Lombard......	54′	4332′	1,673,400	1,811,100
Divisadero—Pine to Lombard....	60′	4332′	1,816,100	1,938,600
High Level				
Divisadero—Sacramento to Greenwich	54′	3294′	1,306,000	1,414,200
Divisadero—Sacramento to Greenwich..........................	60′	3294′	1,417,100	1,513,200
Broadway—Mason to Larkin.......	54′	2338′	870,000	941,100
Broadway—Mason to Larkin......	60′	2338′	944,700	1,007,800

Cost of Other Projects. The cost of any other proposed tunnels for this district may be arrived at with approximately the same unit costs as proposed for the Fillmore Street tunnel—that is, *exclusive of damages and enlargement of approaches.* With respect to these items, the Divisadero Street tunnel will carry a somewhat lighter burden in damages; but on the other hand, the increase in the size of the bore that would be desirable tends to offset this.

Damages. I have not attempted to make any estimate of damages; however, the Fillmore Street Improvement Association has itself prepared an estimate covering the purchase of a 30-ft. strip on each side of Fillmore, from Sutter to Bush, and Union to Filbert. This estimate has been itemized for the various owners and covers land and improvements, as follows:

Land value and damage, south end..............	$ 99,000
Damage to improvements, south end.............	82,500
Damage to land and improvements, north end....	85,000
Total..................................	$266,500

Assuming this to be a fair estimate, the cost of the Fillmore Street tunnel as above outlined, would approximate in round numbers, $2,000,000 single-bore, and $2,100,000 double-bore.

Progress. It is estimated by the City Engineer that by vigorous work with three shifts and drifting from both ends, the headings could be pushed forward at the rate of 450 feet per month, total. On this basis, the Fillmore Street bore would require less than 10 months for actual construction from both ends, or 20 months if from the north end only. It thus appears that, barring extraordinary delays, the Fillmore Street tunnel ought to be completed *at least* within two (2) years from the beginning of construction. This would provide little margin before the opening of the Exposition and would not permit of its use for conveying materials to the grounds during construction unless double headings were employed. Hence it is imperative that the City lose as little time as possible in perfecting its plans for vigorous prosecution of the work.

CHAPTER 11

MARKET STREET EXTENSION TUNNEL UNDER TWIN PEAKS*

Location and Alignment.
Type and General Design.

At the present time there is an area of 10,000 acres, or about one-third of the city, south and west of Twin Peaks, that is practically unpopulated. Much of this area is very desirable for residence purposes, but under the present conditions the time required by existing transit lines around Twin Peaks and Blue Mountain is practically prohibitive. These same hills cut off all direct communication between the Mission and the Park. In this chapter, various plans for relief by means of tunnels are analyzed, and recommendations are made for the location and general design of (1) a Twin Peaks rapid transit tunnel and (2) a Mission-Sunset tunnel. Studies also had to be made for the general design of a subway ultimately to be built under Market Street and its connections with the Twin Peaks project; also for branch connections to the south and west. This Twin Peaks tunnel is designed to serve the double purpose of bringing the entire area southwest of the ridge within the 30-minute time zone and of providing an additional outlet for rapid transit down the Peninsula.

Projects Investigated, Original and Supplemental.

Tunnel Plan No. 1.

Known as the Schussler plan, running from Market and Castro Streets, westward on Seventeenth Street to a point just west of Stanyan Street, thence southwesterly and south approximately midway between Blue Mountain and the most northerly peak of Twin Peaks and coming to the surface on City property near the Dewey Boulevard.

Tunnel Plan No. 2. Subway Plan No. 1.

Submitted by the Twin Peaks Tunnel Association, following closely the alignment of Market Street at low level, but *entirely underground* from Valencia Street to San Miguel Rancho near the junction of Corbett Road and Dewey Boulevard. This plan includes the construction of the southern section of Market Street subway from Castro as far as Valencia Street.

Tunnel Plan No. 3.

A high-level tunnel from Market Street to the southern extremity of the Alms House tract, with surface entrance at Castro Street and the vicinity of Laguna Honda.

Footnote—For additional tunnel projects in other parts of the city, see Chapters 10 and 12.

*Formerly Preliminary Reports Nos. 5 and 8, submitted May 3d, and Oct. 7th, 1912.

Tunnel Plan No. 3A.

The same as Plan No. 3, except utilizing Market Street *extension* to Douglass Street.

Tunnel Plan No. 4.

Surface entrance at Market and Castro Streets, emerging in the San Miguel Rancho at about the intersection of Taraval Street and Dewey Boulevard, with a *sub-grade* passenger and car transfer station in Seventh Avenue Boulevard east of Lake Honda.

Tunnel Plan No. 4A.

The same as Plan No. 4, except utilizing Market Street *extension* with surface entrance at Eureka Street.

Tunnel Plan No. 5.

Combining Plans No. 2 and No. 4; Market Street subway from Valencia to Castro, tunnel to the San Miguel Rancho, emerging in the vicinity of Taraval Street and Dewey Boulevard with *sub-grade* passenger transfer station at Seventh Avenue Boulevard east of Lake Honda and surface car exits at Castro Street and Seventh Avenue.

Tunnel Plan No. 5A.

Same as Plan No. 5, except with *straight extension* of Market Street to Douglass Street.

Tunnel Plan No. 5B.

Same as Plan No. 5 with *curved* extension of Market Street to Eureka Street, following the natural contours around the northern slopes of Eureka Valley.

Mission-Sunset Tunnel.

From Market and Noe Streets, through an open cut on Sixteenth Street, thence by tunnel to the intersection of Carl Street and Cole Street, with the portal located approximately midway between Cole Street and Clayton Street.

Subway Plan No. 2.

This is a plan of subway on Market Street, extending from the Ferry to Gough Street, thence westerly in Haight Street to Stanyan Street, thence northerly in Stanyan Street to Fulton Street, thence northwesterly to a portal near North Willard Street, thence on the surface via Cabrillo Street to the ocean.

It is also proposed that branches of this system be constructed as follows: From the intersection of Market and Haight Streets, thence northerly on Gough Street to Lafayette Park, thence diagonally northwesterly under Lafayette Park to Laguna Street, thence northerly on Laguna Street to Chestnut Street, or on some other parallel streets to be hereafter selected, making a rapid transit entrance to the Exposition site; also another from the intersection of Stanyan and Haight Streets, in a southwesterly direction and on some streets to be selected.

Subway Plan No. 3.

Four-track subway for surface car operation, extending from the Ferry under Market Street and coming to the surface near Brady Street, with inclined entrances for the reception of surface cars, on Hayes Street, McAllister Street, Turk Street, Eddy Street, Geary Street, and Sutter Street, with a loop terminal at the Ferry building.

Plans chiefly considered.

No. 2—"Twin Peaks Rapid Transit tunnel *without* Seventh Avenue connection."

No. 5B—"Twin Peaks Rapid Transit tunnel *with* Seventh Avenue connection."

CONCLUSIONS AND RECOMMENDATIONS.

1. A low-level trolley bore from Market Street to the San Miguel tract, with a maximum tunnel or approach grade of not over 3% is recommended, the alignment to be as direct as possible and practically constituting an extension of Market Street into the Merced district. (Embodied in Tunnel Plan No. 2.)

2. Provision for a Market Street subway should be incorporated in any Twin Peaks tunnel project—*i. e.,* the alignment and grade of the tunnel under the hill should be such as to emerge directly into a suitable subway bore under Market Street, *whether the latter is built now or in the future.* If the cost is too great at present for a subway section, the Twin Peaks tunnel should be built to sub-grade, with inclined portal at the south end of Market Street, so that cars may reach the surface, and in the future the tunnel sub-grade can be extended north into the subway proper. (Eliminates Plans No. 1, No. 3, No. 3A, No. 4, No. 4A.)

3. If the assessment burden is not too heavy at this time, I am in favor of the use of Valencia Street as the present northern terminus of this tunnel-subway project as contemplated in Plan No. 2. Only by this means can open competition be assured for the main tunnel bore. Otherwise, four tracks in Market Street would be necessary.

4. In the event of the extension of the subway to the Ferry, the entire subway bore will be available for both third-rail interurbans and subway locals, the suburbans being routed out of the bore at Castro or Valencia Street, and the subway locals returning via under-ground loop at Castro Street.

5. To meet future rapid transit necessities, additional tracks for through express service *exclusively* should be provided for, in the acquisition of property rights for the tunnel now under consideration. For this purpose, the most direct alignment and lowest grade obtainable are desirable. This *need not necessarily coincide* with the one chosen to meet present necessities.

6. ***Alternative.*** The extension of Seventh Avenue south of the Park by Laguna Honda and the City tract are of strategic importance and even at the expense of a somewhat greater tunnel grade and a less perfect alignment, a subway transfer station for passengers and cars at this point seems essential. (Plan No. 5B.) The appended discussion gives you a measure of these disadvantages, neither of which in my opinion is at all serious. This plan would subdivide a tunnel 16,000 feet in length from portal to portal into three parts, with surface entrances not over 8,900 feet apart.

7. The direct extension of the Market Street alignment from Castro to Douglass Street is quite impracticable, as it seriously disturbs the present gradients in this region and by shortening the main tunnel grade between stations at Market Street and Lake Honda will actually increase (rather than decrease) this grade beyond the 3% maximum established. (Eliminates Plans Nos. 5 and 5A.)

8. The curved extension plan No. 5B, herewith submitted, could be carried out to advantage as an independent street improvement, coincidental with the tunnel construction at sub-grade, although *not essential thereto,* as the subgrade bore is necessary in any event. The only gain so far as the Twin Peaks tunnel is concerned would be to eliminate damages and facilitate construction by the open cut method. This contour approach will be of maximum benefit as an outlet for the "Mission-Sunset" tunnel, proposed herein, and the cost of the extension should be considered as partly borne by the saving in the length of the Mission-Sunset bore.

9. If the Twin Peaks tunnel is located according to Plan No. 5B—*i. e.*, following a curved extension of Market Street at subgrade—the Mission-Sunset tunnel should extend from the surface of Market at Eureka Street to Frederick and Cole Streets in Pope Valley, with a transfer station at Eureka Street to enable passengers to reach Golden Gate Park from either direction. This tunnel should be of a type providing for street car, vehicle, and pedestrian traffic, as already laid out for the Fillmore Street or Broadway tunnels. It should be considered as an important feeder to the Twin Peaks bore from the Panhandle district, *to be constructed as soon thereafter as practicable.* If Market Street is not extended as contemplated in Plan No. 5B, the Mission-Sunset tunnel must then be lengthened over 27%, with an easterly portal at Sixteenth and Market Streets, in all probability; this, however, being dependent to some extent upon future plans for surface line extensions.

10. Finally, I can recommend unqualifiedly the construction of a Twin Peaks Rapid Transit tunnel at the earliest possible date. In so doing, there will be brought within 30 minutes' running time of the business district, approximately 10.000 acres of new territory. 75% of which is suitable for residence land, that has been practically useless heretofore by reason of lack of adequate transportation thereto.

This area extends west to the ocean front and south along the valley as far as the cemeteries. This estimate is based upon present operating schedules. But with higher speed equipment, even this is capable of great improvement and it is quite possible that the valley lands could be brought within the 30-minute zone at least half way to San Mateo.

GENERAL DISCUSSION

Objects in View. In considering these various tunnel enterprises under Twin Peaks, it has been the general object to provide a low-grade outlet from Market Street into the San Miguel Rancho, for the purpose of—

(a) Giving direct access into the business district via Market and Mission Streets for suburban surface cars from the lower Sunset District, San Miguel, Ingleside, Merced, and Ocean View —*i. e.,* extending the suburban commuter area well beyond the County line into the peninsular valley lands.

(b) Providing a more direct and convenient rapid transit entrance to the city from down the Peninsula than is at present afforded by the Mission Street thoroughfare.

In analyzing the movements of the commuter population, it is generally found that the criterion by which one suburban district is judged as against another, rests entirely upon the question of time consumed in transit and in the convenience and attractiveness of the route. Roughly speaking, 30 minutes represents the limit set by the average suburbanite in his choice of location. Frequently, geographical conditions conspire to render a longer trip necessary, but often the attractiveness of the trip operates largely in extenuation of the longer ride; such is the case with the trans-bay commuters.

The extraordinary development across the Bay is a sufficient object lesson in the possibilities of development by limited-stop rapid transit trains.

Vehicle Traffic. It has been contended that a double-bore tunnel, suitable for both rapid transit and vehicle traffic, should be provided; but owing to the extreme length of the tunnel, the latter has been practically abandoned, and the various projects are here analyzed on the bases above enumerated.

High-Level vs. Low-Level. In studying these various propositions, certain important features command instant attention; first and foremost, the grade. If it is the desire of the City to extend south along the Peninsula through the agency of high-speed electric train service, a rapid transit entrance into the city from the south must be provided. For this reason, steep grades in tunnel or approaches and obstructed and circuitous routes are almost out of the question. These conditions practically dictate a low-level location.

Alignment. Unquestionably, the general desire of San Franciscans is for a direct extension on the Market Street align-

ment toward Merced.† With grades not exceeding 3%, the loss of time occasioned by some diversion from the direct alignment would not be at all serious; but if both tunnels, viz: Twin Peaks and Mission-Sunset—are desired, and the *construction funds therefor can be raised* by the property benefited thereby, an approximate alignment with Market Street unquestionably becomes the more desirable from an operating standpoint.

Market Street Extension. Collectively, the status of these various projects is greatly affected by the attitude of the City in regard to the extension of Market Street through the four intervening blocks to Douglass Street. It has been urged that with this extension, a considerable length of tunnel would be saved and with it the necessity of running underground to Valencia Street. It is true that, were this improvement *already carried out,* a strong argument would be presented for a surface grade entrance at Douglass. However, as this has not been done, the following conditions prevail:

1. The cost of acquiring property to extend Market Street as above indicated is considerable. An estimate, which was made by a reliable real estate firm of your city, shows that the cost would be in the neighborhood of $525,000, exclusive of the cost of land and damage at the northwest corner of Seventeenth and Castro Streets.

2. The extension of Market Street in this manner will not permit the extension of Plans Nos. 5 and 5A, combining a sub-way entrance on the north and a sub-grade entrance at Laguna Honda, within the limitations of grade established—3%.

3. Eventually, a Market Street subway will become a necessity, and it will then become equally necessary to route the rapid transit suburban express trains from the Twin Peaks tunnel into this subway, for which purpose an inclined entrance would have to be provided in the streets from surface to sub-grade at some point along Market Street or else by a diverging grade within the tunnel which has some operating disadvantages. But a study of the Market Street profile shows that an incline to sub-grade will be difficult to provide south of Church Street, owing to the street's general slope in the same direction as the tunnel grade,

†Footnote—It appears to be on this score that the otherwise excellent plan developed by an engineer of your city, Mr. Hermann Schussler, was not widely favored—*i. e.,* on account of the diversion, from a direct alignment, through Blue Mountain. The underlying feature of this plan, however, was one of economy and expediency—accomplishing by a single bore the object of two tunnels now contemplated. Furthermore, the alignment under Seventeenth Street was chosen to confine the damages to one large property holder, whose acquiescence had been previously secured, thus avoiding the interminable delays usually encountered in adjudicating the claims of numerous small property holders in the acquisition of sub-surface easements.

and to the short distance between cross streets in the proposed extension strip. Thus, electric express trains would be forced to run along the surface of Market Street for 14,000 feet before dipping under-ground, *which would defeat to a large degree the ends of rapid transit desired.*

4. A study of regrades of lateral streets necessary to carry out the extension of Market Street reveals a hopeless disturbance of the already steep grades in the Eureka Valley. On a comparatively level territory these regrades could be accomplished without difficulty, but with existing grades of 5 to 8%, it is impossible to cut through a diagonal thoroughfare 120 feet in width without practically closing some of the streets to the right and left. This results from the fact that the blocks of realty are so cut up into small irregular polygons that not only do lateral grades become prohibitive, but the efficient utilization of the remaining areas is to a large degree destroyed.

5. Further, it is found that a straight extension would carry Market Street to the foothills without any opportunity of connection with other thoroughfares providing an outlet from Eureka Valley along reasonable grades to the higher levels. Caselli Avenue, beginning at the southerly extremity of the extension, is narrow and immediately encounters ascending grades prohibitive for either automobiles or street cars. Douglass and Eureka Streets both present impossible grades to the south, thus leaving the westerly ascent in precisely the same condition as at the present time.

Contour Extension. A contour plan of extension, however, will prove far more practicable. In developing the alignment of the tunnel sub-grade, points were found around the northerly slopes of Eureka valley where the sub-grade could be located 20 feet below the surface. This alignment was found to approximate the desired route to Laguna Honda station under alternative Plan No. 5B, with Seventh Avenue connection.

This immediately suggested the proper location for an easy grade extension of Market Street into Eureka valley. Leaving the present intersection of Seventeenth and Castro Streets, the Market Street roadway has been gradually drawn down on the curve to the width of 85 ft.—somewhat in excess of California Street, Divisadero Street, and Broadway. The extension reaches Eureka Street at 3% average grade (the same as the subway), and may be carried still further up the hill to Eighteenth Street on about a 5% grade if desirable, thence reaching by Falcon Avenue the present secondary level to the south around Twin Peaks and to the north over Ash-

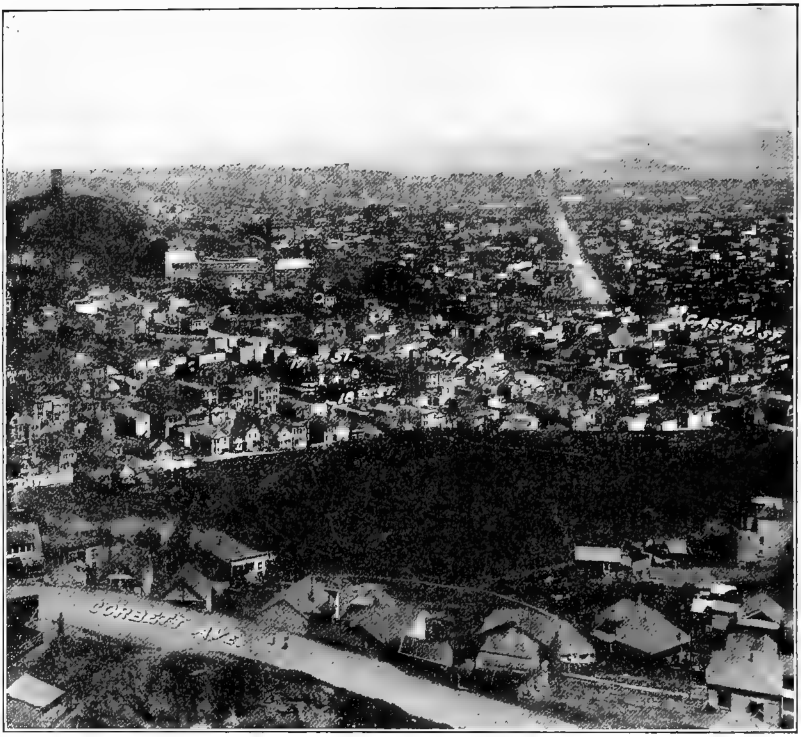


FIGURE 52—EUREKA VALLEY FROM THE SLOPES ABOVE CORBETT ROAD.

Showing existing physical obstructions to the straight extension of Market Street with reference to the proposed locations of tunnels. Caselli Avenue in the middle ground has no practicable outlet except Eighteenth Street and thence to the existing switch-back.

bury Heights. For this extension, 60 feet width would probably serve the purposes in view and least disturb existing gradients. At Eureka Street, it is proposed to locate the southern portal of the Mission-Sunset tunnel to Pope Valley, with a diagonal portal passing under Seventeenth Street and Douglass—the beginning of Corbett Road. The plan will then present the following features:

1. A 3% grade from Castro to the portal of the Mission-Sunset tunnel.

2. The present gradients of transverse streets lying to the south of the extension would be *undisturbed*. Those on the north would be somewhat increased, but the resulting depths of the lots would be such as to permit convenient frontage on both Market and Seventeenth Streets, even at the different levels.

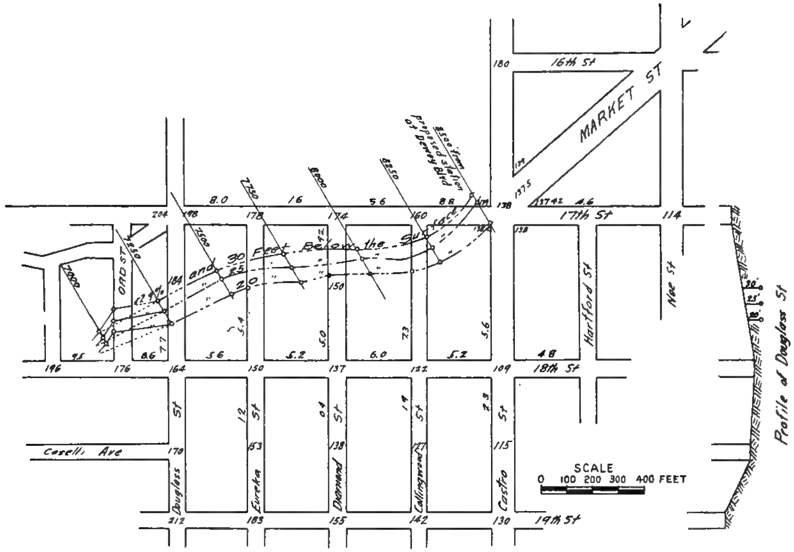


FIGURE 53—CONTOUR STUDY OF TUNNEL ALIGNMENT

Showing possible alignments at different depths below the street surface for Plan 5B. Based upon established grades and uniform grading between streets. This virtually establishes the range of possible construction except with extensive regrading.

3. The plots of realty would be cut up into nearly *rectangular* areas without disturbance of present corner lots, except at the curve south of Castro.

4. A subway station near the Eureka Street portal would provide transfer facilities in both directions between the subway lines, Market Street and Sunset lines, and with Eighteenth Street by a walk of 200 to 300 feet.

5. A high-level entrance to Market Street for local trolley cars from the south.

6. A 3% grade extension to both the present boulevard levels around Twin Peaks—Corbett Road and Falcon-Ashbury Avenues—suitable for direct car line connections with Market Street. However, this is to be regarded as a *street improvement* and not an integral part of the tunnel project.

Tunnel Grades. In Plan No. 2, *without* Seventh Avenue connection, a tunnel grade of about 2% has been secured. While the lowest grade is desirable, it would not be unreasonable to establish a higher grade, if compensating advantages could be secured.

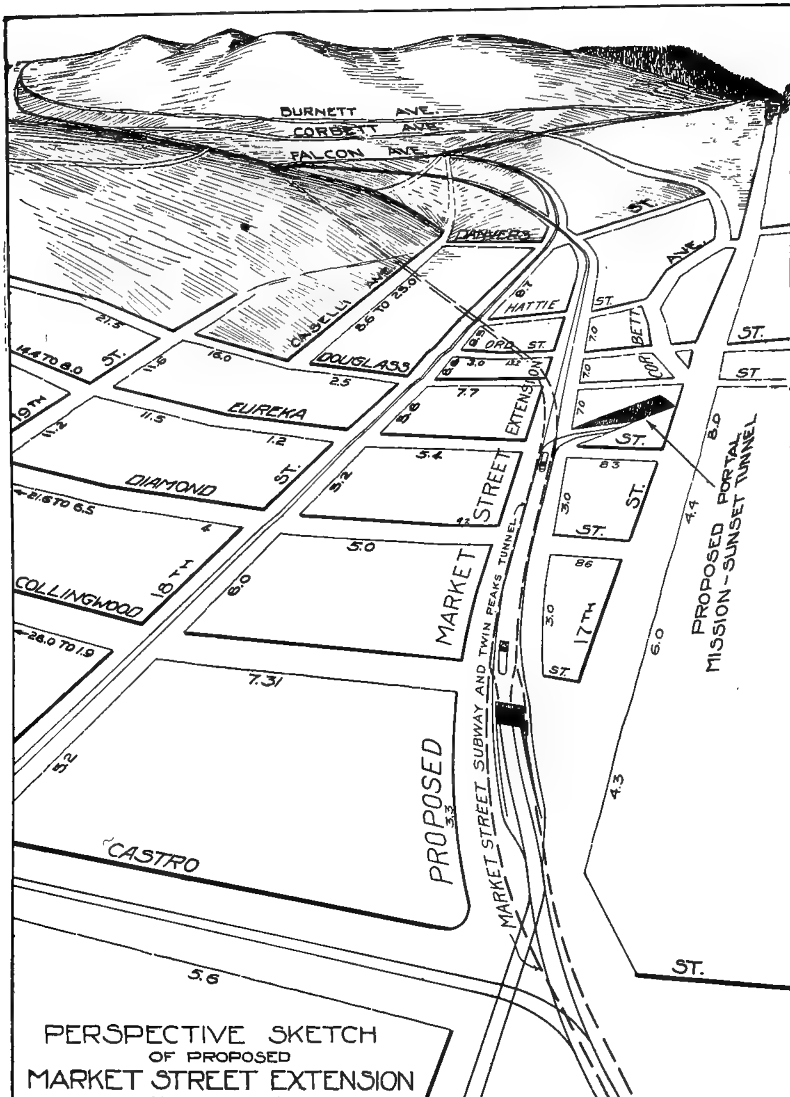


FIGURE 54.—PERSPECTIVE SKETCH OF EUREKA VALLEY.

Showing Market Street extension and relative position of Eureka Valley station and Mission-Sunset tunnel. Also indicating the impossibility of extending Market Street straight across Eureka Valley if an outlet is desired. This secures easy grade for both tunnel and street.

The maximum grade permissible in a long tunnel is really determined by the loss of time and the heating capacity of the motors. Assuming the present standard surface car equipment to be used through the tunnel, the maximum motor temperature that would be expected for continuous operation along the streets could safely be placed at 70 or 75 degrees Centigrade. Tests on the Sutter Street line, which is perhaps the heaviest line in the city, considering both grades and passenger traffic, have shown that the continuous temperatures average around 65 degrees Centigrade. The permissible extra rise in temperature and extra time consumed due to climbing the tunnel grade at full speed then will determine that grade. And it is found that, allowing as low as 5 degrees extra rise, a standard car with 30 tons total load could climb a 3% grade for over one hour, or a 4% grade for nearly one-half hour. This shows that for a tunnel of this length a grade of 3% or 4% is not serious. However, a 3% grade will consume 0.47 minutes and a 4% grade 1.07 minutes additional running time. From a general standpoint, therefore, a 3% grade could readily be used, but in my judgment this should not be exceeded at any point in an alignment designed for rapid transit purposes.

Portals. The contemplated portal of Plan No. 2, in McCoppin Street (formerly Hermann Street) can be accomplished with an easy grade incline without the acquisition of property and with the necessary preservation of the roadway by the location of the portal at the side of the street adjacent to a large block of property bounded by McCoppin, Valencia, Brady, and Mission, *which is contemplated for use as a terminal and storage ground.*

A surface entrance portal in the southwestern edge of the Alms House tract at the junction of Dewey Boulevard and Seventh Avenue extension presents the difficulties of a long grade of 8% at the southwest approach, which is practically prohibitive. The best grade obtainable from the surface at Seventh Avenue *to the surface* at Market Street extended is 3.09%, while the best grade to Market Street subway level is 3.26%. This practically eliminates a surface portal along Seventh Avenue extension boulevard (Plan No. 3).

A surface entrance portal some 2000 feet southwest in the San Miguel Valley near the intersection of Taraval ("T") Street and Dewey Boulevard appears to be the only possibility for preserving an easy grade through the main tunnel if built for rapid transit express trains. This alignment will cross a deep gully before reaching the Sloat Boulevard intersection, but it is evidently desirable and already contemplated to utilize the tunnel

excavation for filling in this gully throughout its length to create more desirable residential property. The choice of the exact location is merely a matter of *minimizing the amount of fill* necessary to provide an even grade to Sloat Boulevard.

Seventh Avenue Extension. Plan No. 2, while possessing the unquestioned advantages of good alignment and grade, yet eliminates *for all time* the possibility of a passenger or branch line entrance from Seventh Avenue extension Boulevard which traverses a large area next to the Alms House tract approximating the 400-500 foot level.

It is necessary to recall here that Seventh Avenue is the *only southerly outlet* from the northeast section of Sunset, which is now the most heavily settled territory south of the Park. It is a natural defile or pass, which will provide an excellent grade when the roadway is regraded past Lake Honda as already contemplated by the City. It is therefore not unreasonable to expect that ultimately a Seventh Avenue car line extension will be carried around Twin Peaks by a regraded roadway, communicating with Corbett or Falcon Avenues, and thence to existing car lines of Eureka Valley and the Mission.

Laguna Honda Station. By thus taking advantage of the natural contours of the Honda Valley, it is possible to secure the following results:

1. A passenger transfer entrance into the tunnel at "Laguna Honda" station. This will bring the future residents in this Honda Valley within reasonable walking distance of the tunnel.

2. An easy grade connecting car line in Seventh Avenue.

3. A grade of not over 3% in the main tunnel and its approaches.

The advantages of such a car line connection may be appreciated from the fact that with a line across the Park, Richmond, the most thickly settled of the northern section would have access to this rapid transit route down the Peninsula. A more direct route from the Presidio down the Peninsula could hardly be found.

Market Street Bore. In planning the subway section of this Twin Peaks bore, it is essential that the section adopted should be such as to conform to a reasonable design of future subway extension down Market Street, both as regards alignment and grades. It is therefore necessary to adopt a subway bore which will make it possible for the *station platforms to be located at the minimum dis-*

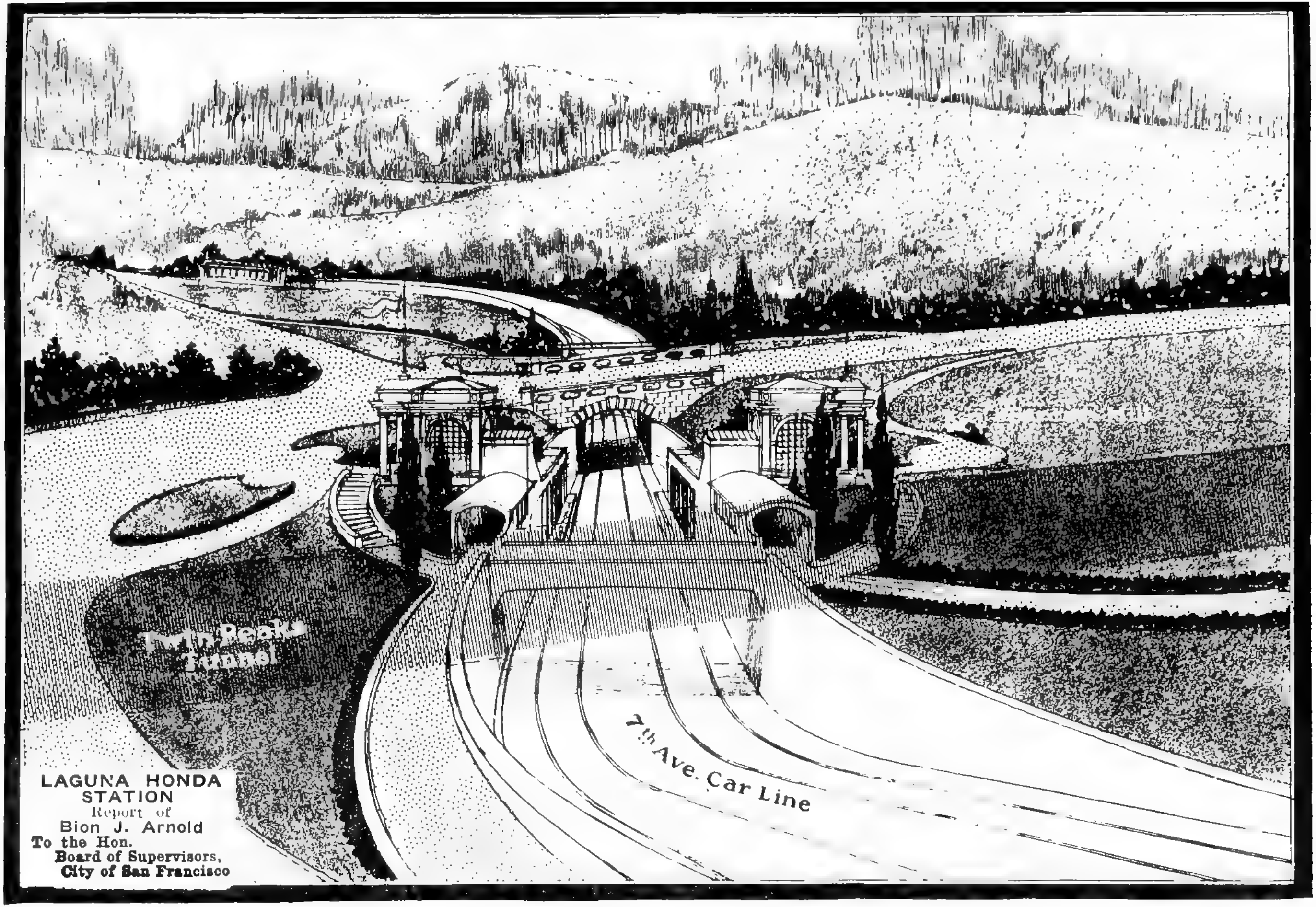


FIGURE 55.—PERSPECTIVE VIEW OF LAGUNA HONDA STATION.

Showing possibilities of open cut construction to provide transfer facilities with tunnel and the extension of Seventh Avenue as an additional boulevard down the Peninsula.

tance from the street surface; there are *three possible alternatives* in determining the method of junction of the tunnel and subway bore at Market and Castro Streets:

1. A third-rail bore in Market Street from Eureka or Castro north, of minimum height—13 or 14 feet—just sufficient for roof clearance only; to receive *only third-rail* interurban and subway cars, all surface trolley cars being routed directly from the trolley tunnel to the surface on Market Street by the inclined approach already provided for in Plans No. 2 and No. 5B.

2. Increase the height of the bore slightly to 15 or 16 feet—just sufficient to admit trolley cars—this bore to merge into a 14-foot third-rail bore at Valencia Street where all local trolley cars would be routed out of the bore.

3. To extend the 19-foot trolley bore as far north as Valencia, there routing out all trolley cars and merging into the 14½-foot third-rail bore at sub-grade.

From the standpoint of long-distance rapid transit, the first alternative is undoubtedly the best, but would necessitate all of the suburban trolley cars from Parkside, Ingleside, and Ocean View, to run on the surface of Market and Mission Streets to the Ferry. This would not be a serious handicap at the present time, as upper Market Street is not now congested, the grades are not serious for surface cars, and suburban traffic most logically *belongs on the surface* of important business thoroughfares.

The second alternative would make it possible for the longer suburban lines also to route underground as far north as Valencia, although increasing the cost of the bore somewhat.

The third alternative can be justified only on the assumption that a Market Street subway extension out Valencia is out of the question for a long period of years. And the depth of the station platforms is so great as to almost put it out of consideration. With a subway bore 14½ to 15 feet high it would be possible to locate station platforms about the same distance below the street surface, allowing 2½ feet above the water-proofing for paving and utility structures desiring to cross the roof arches.

Traffic Connections. Whatever the type and alignment selected, it is absolutely essential not to lose sight of possible traffic connections with existing or future surface lines. As I understand it, this tunnel is to be open to use by any railway desiring an entrance into the city upon an adequate rental basis; hence it will be necessary for the City to have complete control of its tributary lines through proper location of the tunnel portals.

Considering the northern portal; if by extending Market Street, the tunnel were to reach the surface of Eureka Street at grade, there would eventually be *no possible chance for an independent entrance except* by the granting of a franchise for *two more tracks* on Market Street, or else the diversion to and use of Seventeenth Street into Mission, upon which grades are not favorable. But an independent interurban line could make its terminal at Valencia Street without serious inconvenience. Surface lines emerging at Mission Street, could find easy outlet to the north via Franklin, Van Ness, or Polk Street. Under charter rights for joint operation, connection could be made with the Geary Street road on any of these streets or to the Civic Center. By the *extension of Van Ness Avenue to Mission Street,* which is very desirable in any event (as Van Ness Avenue is now a blind street) it would be possible to route directly to Harbor View from the southern territory.

Further details of the relation of this project to a future Market Street subway are discussed in a succeeding chapter.

Mission-Sunset Tunnel

A project secondary only in importance to the Twin Peaks project herein discussed has been advocated at various times for the purpose of providing a more convenient outlet to Golden Gate Park and the upper Sunset from the Mission and all the territory south of Market Street including Noe and Eureka valleys. It is now possible to reach upper Sunset only through the narrow throat between Blue Mountain and the Park and by only *two through streets*—Frederick Street and Parnassus Avenue, Carl being a blind street. While the lines running east and west through the Panhandle give ample opportunity for residents north of Market Street to reach the Park and the Beach by Lincoln Way and Fulton Avenue, the residents of the Mission can only secure this entrance by extremely circuitous routes, any of which consume too much time for the distance traversed, viz.:

Valencia—transfer at Haight or McAllister Streets.

Sixteenth and Mission—transfer at Haight or McAllister Streets.

Eighteenth and Ashbury—transfer at Stanyan Street.

Locations proposed for this Mission-Sunset tunnel are as follows:

Sunset Plan No. 1—Sixteenth and Noe Streets to Carl and Cole Streets.

Sunset Plan No. 2—Seventeenth and Castro to Frederick and Cole Streets.

Sunset Plan No. 3 (Twin Peaks Plan No. 5B)—Eureka and Market Street contour extension to Frederick and Cole Streets.

Sunset Plan No. 1 is practically an extension into the Sunset District of Sixteenth Street, the most important transverse thoroughfare through the Mission. At this point a subway station was contemplated in Market Street and likewise a Divisadero cross-town line via Noe Street.

In Sunset Plan No. 2, the tunnel would debouche practically at the upper end of the present Market Street and more convenient to the Castro and Eighteenth Streets lines with also a subway station at this point in all probability. This entrance would shorten the tunnel by about 320 feet.

The advantages of Plan No. 3 with an eastern portal at Eureka and Market Streets (extension) have already been dwelt upon in the discussion of the Twin Peaks project No. 5B. This tunnel is about 1,000 feet shorter than called for by Plan No. 1.

In my judgment, the westerly portal should be located in the natural depression of Cole and Frederick Streets, and west-bound cars through the tunnel into Market Street should be given the *preference* in this level thoroughfare rather than to divert the tunnel to Cole Street which is a blind street, ending at First Avenue; for, in all probability, if this tunnel were built, most of the daily travel will be routed via this tunnel and Market Street. Eventually, the widening of Frederick Street at the Park entrance by the extension of Lincoln Way to Stanyan may become necessary to alleviate this narrow throat into the Sunset District, but such an important undertaking as the Mission-Sunset tunnel, in my judgment, should have the right-of-way.

Comparing these three plans it is found that the Sixteenth Street entrance will require a bore 4,720 feet long to Frederick Street, or 27% more than the third plan, 3,720 feet; the latter plan of course is only feasible in the event of the extension of Market Street as proposed in Twin Peaks Plan No. 5B. With the Carl Street portal, Plan No. 1 is 32% longer than Plan No. 3.

In this tunnel there exists an urgent necessity for vehicle traffic, and in spite of its length, the possibility of an easy haul from the Mission to the Beach with grades not exceeding 3 or 4% must not be overlooked.

Details of type of bore and portal locations are presented in the succeeding pages.

TYPE AND GENERAL DESIGN

Essential Points for Consideration

First. Location of the Market Street bore within the limits of the present roadway.

Second. Number and location of stations.

Third. Type of stations.

Fourth. Relation of the present tunnel project to future rapid transit projects which must necessarily connect thereto.

Fifth. The best arrangements for cross-town transfer connections at Laguna Honda station.

These are discussed from two entirely different viewpoints:

Project A. Relates to that type of structure best adapted to present needs:

A-1. Main or hill section of Project A—Eureka Street to southwest portal.

A-2. Subway section of Project A, from Eureka Street to northeast portal at Mission Street.

Project B. Relates to subsequent rapid transit projects indicating what provision must be made in the first structures for the probable demands of the future in the shape of additional main and branch subway connections.

The development of studies for the latter, Project B, that may appear somewhat elaborate, have been necessary in order to avoid serious blunders which are easily made in planning rapid transit projects due to under-estimation of future growth. The history of most rapid transit projects, brief as it is, has shown that this growth has generally been under-estimated rather than over-estimated. And the transit developments across the Bay and around Los Angeles offer a sufficient testimony to the possibilities of the near future.

General Description of Project. The complete project as recommended herein conforms in general to that described in the foregoing section. In addition to the assignment of stations and the general design of structures, the following modifications have been incorporated (Plate 13):

First, the supplementary inclined portal near Castro Street has been removed from Market Street and located within the limits of

the triangular plaza just west of Castro Street at the commencement of the Market Street contour extension, where little traffic obstruction will occur.

Second, the supplementary entrance portal for surface cars at Laguna Honda station has been modified so as to provide a through crossing for a future Seventh Avenue cross-town line, with transfer connections to the tunnel station.

Third, Laguna Honda station has been located on City property, so as to constitute an attractive transit center at the bend in Dewey Boulevard capable of effective future development, in connection with a Seventh Avenue boulevard extension to Corbett Road and down the Peninsula.

Fourth, a future diversion of the right-of-way south of the San Miguel portal is recommended to secure the necessary grade separation through the Ingleside District.

CONCLUSIONS AND RECOMMENDATIONS

1. Concerning Project A, main or hill section, later studies have confirmed the previous recommendation, that if it is determined to build at present only the main portion of the tunnel between the southwest portal and Eureka Street, the northeast end of the tunnel should be built with the object of *connecting at sub-grade* with a future Market Street subway, and not connecting directly with the surface grade. An inclined entrance would then become necessary at Eureka Street which could be ultimately abandoned, or utilized for routing trolley cars to the surface at this point.

2. Whether the tunnel is extended down Market Street at the present time or not, I am convinced that *the contour extension of Market Street should be carried out at once while the property is relatively inexpensive.*

3. This contemplates also the construction of the contour Boulevard around Twin Peaks, as advocated by the various Improvement Associations. This low-grade extension of Market Street will form the much needed traffic thoroughfare down the Peninsula, supplementing the rapid transit tunnel.

4. Concerning the second section of Project A, this should be built as a two-track subway from West Mission Street to Castro Street along the *north side* of Market Street at *high-level;* that is, with station platforms as close to the street surface as the structural design will permit. In this manner, a future parallel bore will be provided for at minimum cost, to be built at sub-level (that is, at a depth sufficient for an overhead concourse). Thence it will proceed

directly through the hill at low-grade from Castro Street to the southern portal.

5. Acquire sufficient easement width when the first project is carried through to accommodate both present and future bores, as well as stations. The additional cost at the present time for both bores will probably be but little more than for the first.

6. Considering the limitations imposed by the necessity for reasonably rapid operation through the tunnel, not more than three stations between the north and south portals appear to be desirable for the present:

"Church Street," located in the valley at Fourteenth and Church Streets; side platform, sidewalk entrance.

"Eureka Valley," located along Market Street contour extension, between Collingwood and Eureka Streets; island platform, central entrance kiosk.

"Laguna Honda," located on City property at the intersection of Seventh Avenue and Dewey Boulevard; side platform, escalator or ramp entrance.

One future station, "Noe Street," has been provided for by raising the tunnel grade to the proper level; but this should be built for local stops, and only when the development of cross-town traffic warrants.

7. Both Market Street stations, at Church Street and Eureka Valley, should be built at high-level. Church Street may be developed later into a sub-level type express station later described, with the necessary direct transfer facilities between express and local platforms.

Eureka Valley station may be expanded into a reservoir station as soon as traffic warrants, so as to provide "passing tracks" for through service or in conjunction with the branch-off tracks of the proposed Mission-Sunset tunnel connecting at Eureka Street. This will be independent of the future low-grade bore of Project B, which will pass beneath Eureka Valley station, either on the same alignment or a more direct one.

8. Laguna Honda station should be constructed at the highest level consistent with the maximum grade established—3 per cent—but at sufficient depth to permit a future overhead crossing beneath the surface of Dewey Boulevard for trolley cars of connecting transfer lines, this super-grade crossing to be developed as soon as traffic conditions warrant, but independent of the present tunnel station.

Laguna Honda station has been located largely on City property, and an unusual opportunity exists for effective utilization and enhancement in value of the entire City tract. The improvement of

this locality and the boulevards leading thereto should therefore be undertaken by the City at its earliest opportunity. An open cut crossing for trolley cars will save much of the expense of a covered sub-grade station such as shown herein.

9. The upper Market Street subway section should be designed so as to connect directly at subway grade with a future four-track section extending down lower Market Street. All subway branch-off lines should be designed *without grade crossings*. Present designs must fit into a proper scheme of future development without necessitating expensive reconstruction, particularly with reference to station structures.

10. The lower Market Street subway section, which will become necessary in the future, should be built with a standard four-track section, with all four tracks built at sub-level, permitting an *overhead concourse from sidewalk to sidewalk* beneath the street from which access may be had to both express and local platforms, with direct transfer between them. This section is well adapted for connection with the upper Market Street section of Project A, as herein recommended. It is idle to consider a two-track section, because of the number of branches that will probably be required.

11. In the location of stations, provision should be made for ultimately extending the platform to accommodate the longest multiple-unit train contemplated. For the present, both high-speed interurban and trolley suburban cars will be operated through the tunnel. This dissimilarity in equipment makes it desirable for these two types to *berth at separate platforms;* consequently, stations not less than 350 feet in length should be provided for at present, accommodating three-car interurban trains and three trolley car units. On account of this length of platform, and the serious loss in speed due to additional stops, stations should not be built closer than 1500 or 2000 feet.

12. An inclined exit at Castro Street will be required, so long as both local and express trains are operated through the hill tunnel, to relieve the Market Street subway section of such locals as do not require a through run. The incline utilizes otherwise waste space west of Castro Street in order to obviate an obstruction in upper Market Street.

13. Enlargement of the present two-track project to four tracks must come when the safe minimum headway has been reached, under conditions of minimum safety factor as determined by rigidly applied rules for the style of equipment and the type of signal system installed.

14. The relative volume or headway of express and local traffic that can be accommodated effectively within the one bore should

be largely determined by the necessities of express service. This is the principal object of the rapid transit project.

15. Before traffic necessitates a second or express bore, it is likely that local suburban service can best be handled in the present bore by special subway equipment running between the City and the County Line, with adequate transfer facilities en route to numerous trolley feeder lines. And as a lower Market Street subway will probably also be required by this time, it will then become desirable to exclude all but standard subway equipment from the rapid transit system.

16. When the ultimate Market Street subway project is completed from the Ferry to Eureka Valley, a Market Street local or transfer route will become desirable. For this purpose provision has been made at Castro Street for subway locals to loop around in Eureka Valley close enough to Eighteenth Street to warrant a loop terminal station for originating or transfer traffic in addition to the main Eureka Valley station herein provided for.

17. Branch subways will unquestionably become necessary in the future, to feed the main Market Street artery. These branches will be discussed in more detail later, but the development of the city seems to indicate the following as most desirable:

(1) South, or Mission branch;
(2) West, or Park-Richmond branch;
(3) Southwest, or Park-Sunset branch.

All run beneath the surface until out of the heavily settled districts.

18. Grade separation will ultimately become necessary below the southwest portal. The present right-of-way contemplated along Junipero Serra Boulevard can only be regarded as a makeshift, and ultimately the rapid transit line should be diverted one block east by open cut or sunken roadway. It is extremely important that subdivision of residential properties should be carried out with this in mind.

19. Ventilation and automatic block signal plants will become more and more necessary as traffic through the tunnel increases. Provision for the former should be made in the original design, and some form of block signal will be required from the start, to be later perfected and amplified in order to handle effectively the denser traffic.

20. The McCoppin Street portal may be retained after the upper and lower Market Street bores have been connected, as a most convenient means of access to a terminal property which will presumably be located in that vicinity, at least for interurban trains. But the exact position of this portal will be dependent considerably upon the location of this terminal property.

GENERAL DISCUSSION

Determining Factors in Location. In the substitution of the contour Plan No. 5B, for the direct plan of alignment, No. 2, the controlling feature is the adherence to the contours outlining Eureka Valley in order to obtain as low a grade as 3 per cent from Castro Street to the Laguna Honda station. As the hillside slopes rapidly at this point, the alignment of the bore and also that of the Market Street extension depends upon the following quantities, which likewise apply to lower Market Street:

1. Depth of street railway tracks and substructures.
2. Intervening depth allowed for utilities or passageways.
3. Depth of tunnel roof structure.
4. Type of car—height of maximum clearance point on roof.
5. Minimum permissible clearance overhead.
6. Desirable depth of station platforms below surface.

In this alignment, it is desirable, first to reduce the reverse curve beginning at Castro Street to the easiest possible curvature; second, to locate the center line of the bore as far south as possible, so as to better reach the Eureka Valley District. However, the steepness of the slopes renders impossible any material variation in the alignment, so that the final determining feature is the permissible depth of the tunnel roof and superstructures. (See Fig. 53.)

On account of the numerous opportunities for crossing the bore at streets located *between stations* where there is plenty of roof covering, it is not deemed desirable to depress the bore at stations to provide for possible utilities, which, if of moderate size, can be carried across the tunnel roof between beams or can be taken care of by deflecting siphons. However, if overhead concourse or passageway were necessary, the entire bore would have to be depressed about eight feet. A total depth of four to five feet below the street surface to the under side of the tunnel roof is the minimum that may be considered, including surface tracks, six to eight-inch protecting cushion, waterproofing and roof. As later discussed, the minimum inside height of the bore should not be over 14½ to 15 feet from the rail-head, which brings the station platforms to a depth below the street surface of 14½ to 15 feet. This is representative of "high-level" construction referred to herein.

Car loading must take place if possible on a tangent or straight line. This practically dictates the reverse curve shown in the alignment between Castro and Douglass Streets. But approach curves of very long radii have been used so that efficient operation thereon will not be interfered with. All of these considerations have re-

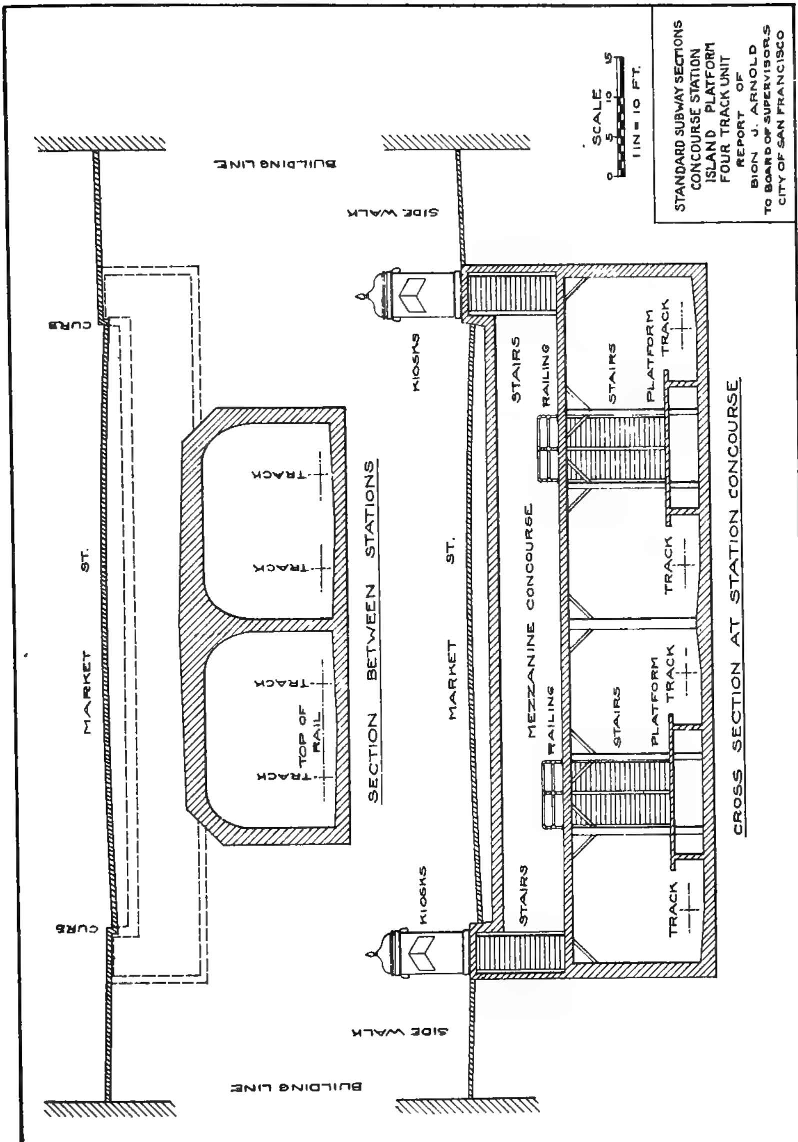


FIGURE 56.—STANDARD FOUR-TRACK SUBWAY SECTION.

Depressed for mezzanine concourse crossing between sidewalk entrances. Double island platforms.

sulted in the choice of the contour alignment shown in the accompanying plan, Plates 13 and 14, and in turn have also dictated the exact location of the Market Street contour extension referred to herein.

Types of Construction. The simplest construction plan would consist in a two-track bore extending from the southwest portal to Eureka Street, where an open cut incline would be built from subgrade to the surface. This plan would be followed in case it is decided *not* to construct the upper Market Street subway section at the present time; but it practically *requires* the extension of Market Street along the contour plan. The inclined entrance could, of course, be moved northeast as far as Castro Street, without extending the street, but the cost of easements and damages to overlying property during the construction of a shallow flat-roofed bore would be proportionately so great as to make it desirable to secure the extension of Market Street at this time.

A study of the profile of Market Street shows that two entirely different types of construction are warranted for upper and lower Market Street, respectively, which fortunately fits well into the present plan of locating the inner portal at West Mission Street. Owing to the rapidly rising ground southwest of Valencia Street, it is *impossible to follow the contour of the surface,* as in the case of lower Market Street; consequently, no stations are permissible between Valencia and Church streets.

Considering, now, this construction on both upper and lower Market Street, there are four types of subway section that may be seriously considered:

(*a*) *Standard Four-Track Unit.* A flat-roofed, two-bore section, carried at sufficient depth below the street surface to permit of an overhead or mezzanine concourse between sidewalks, thus providing an effective transverse passenger subway at all stations. This type will permit platforms to be built at approximately 23 feet below the surface (Fig. 56). It represents standard construction used in other cities, and although possessing probably the minimum construction cost, it has the disadvantage that *platforms of both bores are depressed eight feet* on account of the mezzanine gallery. This passageway, however, may be necessary for lower Market Street in the future.

(*b*) *Independent High-Level 2-4 Track Section.* Project A covers the first high-level two-track bore. Project B has two different independent single-track bores built after Project A at sub-level to permit mezzanine concourses. (Fig. 57.) This type has the distinct advantage that at least two *platforms at all stations*

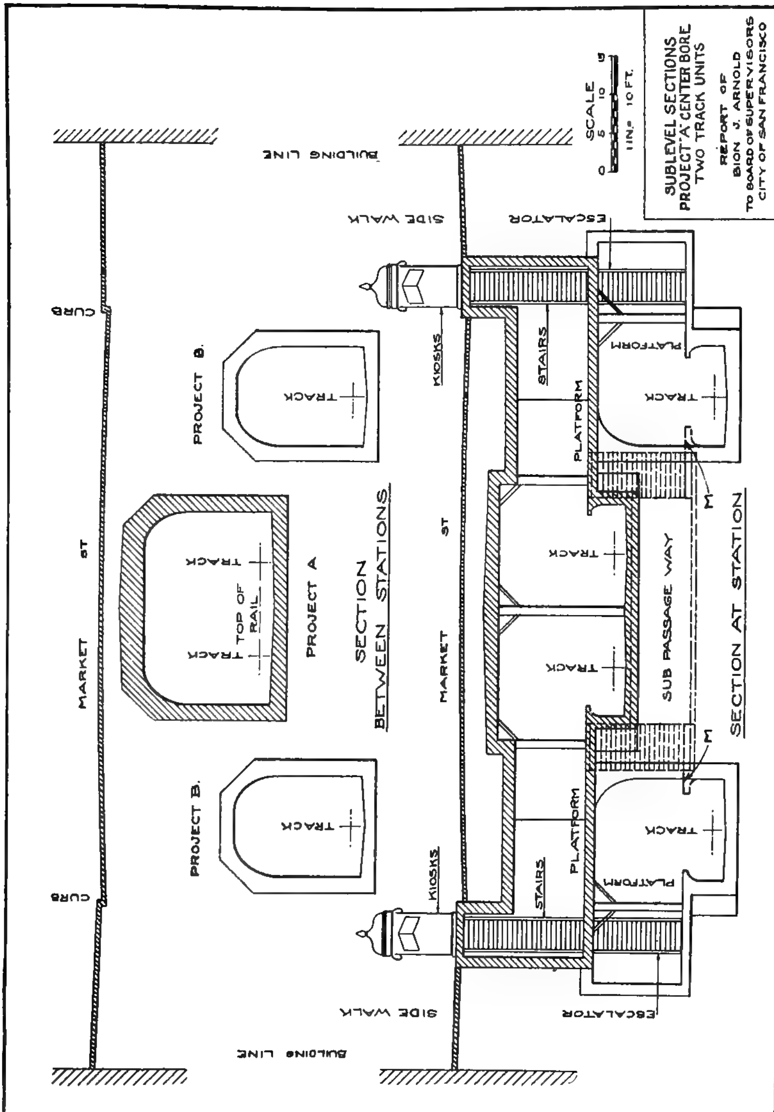


FIGURE 57—INDEPENDENT SUB-LEVEL SUBWAY SECTION

Two-track Project A at high level; future Project B, in two independent tracks, at low level. Sub-concourse with transfer facilities.

may be brought 8 feet nearer the street than in the previous type. It is well suited to upper Market Street, but would entail considerable additional cost on account of driving independent bores and additional material required for walls.

(*c*) *Four-Track Sub-Level Unit.* With mezzanine concourse to sidewalk entrances. Same as previous type, except that the entire construction is to be carried out as one project, thus reducing construction cost below type (b), but costing about the same as type (a). Here the saving in excavation is offset to a large extent by greater expense for division walls, depending of course upon the character of material encountered. This section is suitable for construction on either upper or lower Market Street as a four-track project.

(*d*) *Independent Sub-Level* 2-4 *Track Type.* With separate two-track bores constructed at different times—Project A, high-level, and Project B at sub-level—thus permitting a mezzanine concourse to the sidewalk. The intervening distance avoids disturbance of Project A by construction work on Project B. This plan is distinctly suitable for upper Market Street under the present conditions, and is recommended herein. For lower Market Street the standard unit section, Type (a) is recommended, the advantages of the mezzanine concourse outweighing the disadvantages of deeper station platforms.

It is probable that for lower Market Street a two-track bore need not be taken into consideration, for when the time comes for construction four tracks would without doubt be required, by reason of the necessity of *merging various subway branches from* Richmond, Mission and Sunset into the main Market Street artery. This is only of interest now in case Market Street receives these district subway branches. And if each branch should be operated to its full capacity, a diversion of one or more to a parallel street might even become a necessity.

Station Platform Arrangements. Two arrangements of platforms with their modifications are here available:

(1) "Island" platform—located between inbound and outbound tracks. This is a simple form for a two-track bore, but is limited in capacity because of the intermingling of incoming and outgoing passengers. However, in the four-track arrangement it is exceptionally valuable in permitting quick transfers across the platform between express and local tracks. Fig. 56 shows the "island" platform in its best form, and Fig. 60 in its simplest form as designed for Eureka Valley. Fig. 59 shows a direct transfer between center platforms, with one flight of stairs to sub-level,

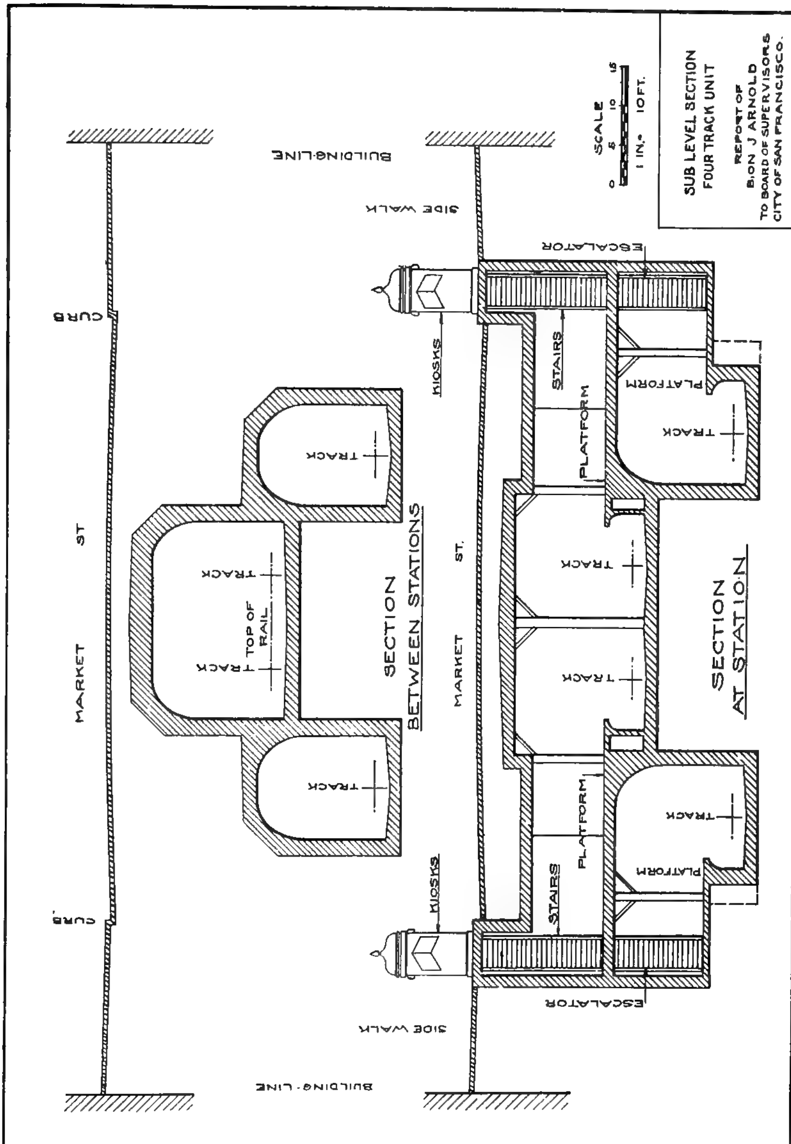


FIGURE 58—FOUR-TRACK SUB-LEVEL UNIT SECTION.

Center local tracks at high level; side express tracks at sub-level, well suited to Market Street.

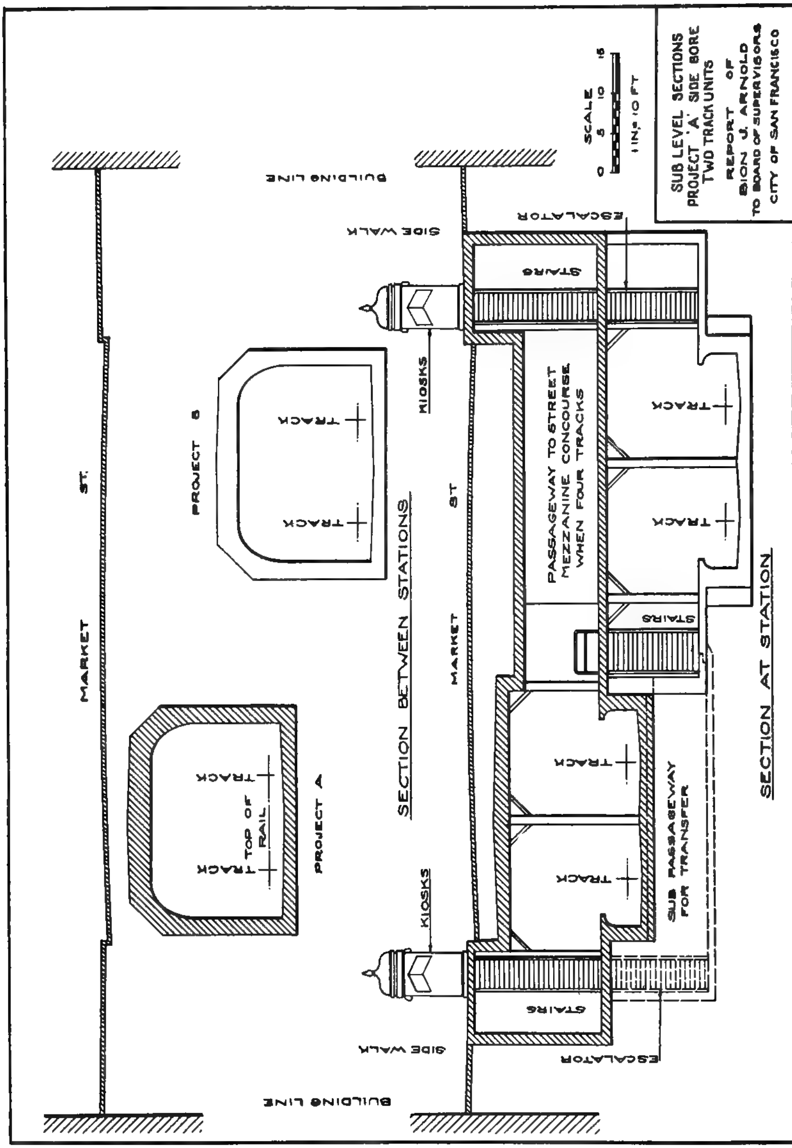


FIGURE 59—INDEPENDENT SUB-LEVEL TWO-BORE SECTION.

Recommended for upper Market Street, Church Street station. Project A, high-level; future Project B at sub-level, with transfer facilities. Both projects are on off-side alignment.

This arrangement is ultimately suited for upper Market Street at Church Street station.

(2) Side Platforms.—For a heavy two-track line, this is superior to the "island" platform in capacity. It has also the advantage that in the future it can be readily expanded into a four-track island reservoir station, permitting passing tracks without necessitating complete reconstruction of the station except the excavation and construction necessary for the outer pair of tracks. This will be the case at Church Street.

But usually entrances must be made from the sidewalk, as only in special cases is it permissible to use island kiosks in the center of the street. Fortunately, Market Street is of suitable width for securing sidewalk entrances. Fig 56 shows the sidewalk kiosks leading to a mezzanine concourse and thence to the depressed island platform. In the case of the sub-level type, the stairway is simply extended to the lower level, as in Figs. 58 and 59. Here the sub-level platform is about 30 feet below the level of the street; consequently, in locations of extremely heavy traffic, a moving stairway or escalator will be desirable.

It is becoming the practice in Eastern cities, where sidewalks are congested, to replace sidewalk kiosks by entrances through stores or business houses located on abutting property. Generally office buildings and department stores are more than willing to devote necessary space for this purpose in order to secure the advantage of a sub-level entrance in the building. In such cases the elevator service of the building in question becomes available for the entrance to the tunnel.

Eureka Valley Station. After numerous studies a central island platform for Eureka Valley station was finally decided upon. It was found impossible to carry the present bore at high level along the north side of the street and in this position secure sufficient overhead clearance for sidewalk entrances to an island platform so as to permit future expansion of the project into a four-track reservoir station with island platform, without widening the street or acquiring additional property beyond the 90-foot width which has been determined upon for Market Street extension at this point. And side platforms with off-side alignment would require four entrances, which is undesirable and more expensive. Similarly, it was impossible to provide central entrances of reasonable size to serve this *off-side alignment* of the present bore, owing to the limiting roof clearances.

With the plan shown herein, central island kiosks in the middle of the street may be used. They are located directly behind the inclined portal at Castro Street, and also serve as safety loading

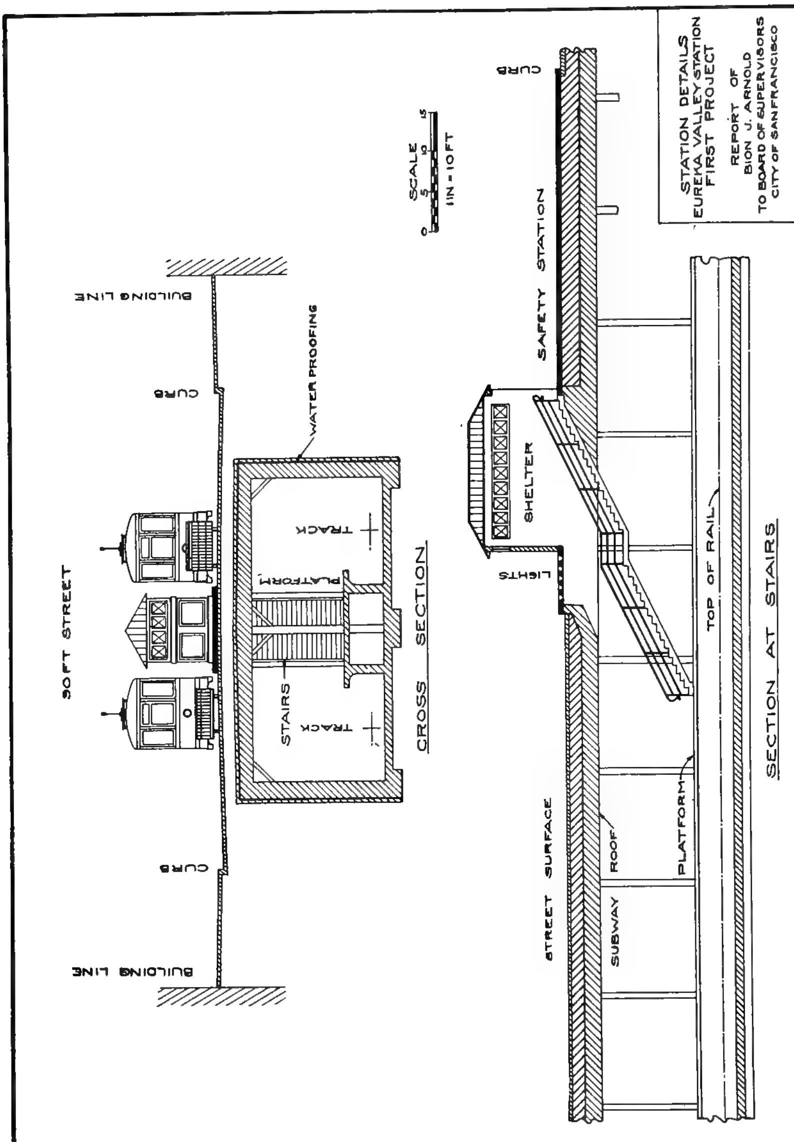


FIGURE 60—EUREKA VALLEY STATION, HIGH LEVEL PROJECT.

Island platform, center entrances, in Market Street contour extension, with provision for future reservoiring to four tracks to accommodate Mission-Sunset traffic.

stations for the surface trolley lines which will later pass on either side of the kiosks into the proposed Mission-Sunset tunnel, or by the proposed Market Street extension further up into Eureka Valley. These central kiosks lead directly to a central island platform of the type previously described.

Either of these "off-side" subway plans would require extensive reconstruction when the second bore was put through, but the central alignment permits of expansion into a reservoir station with only modification of platforms. The second express bore will pass beneath at low grade. And it is deemed unnecessary to provide for transfer facilities between the present bore and this future express bore, for the reason that no extensive cross-town transfer business may be looked for in this vicinity that could not as readily be handled at the Church Street station.

After much study, I am convinced that instead of providing small stations at frequent intervals, it is better to establish a station of ample size extending between streets along the tangent which will ultimately accommodate a train of six to eight car units. For real rapid transit these stations should not be nearer than 1500 to 2000 feet, especially in sections of lighter traffic density.

Noe Street Station. Owing to the proximity of Eureka Valley station, another station has not been provided in the present plan for the intersection of Noe and Sixteenth Streets. However, if the development of cross-town traffic warrants the establishment of the contemplated Divisadero Street cross-town line, a local subway station at this point may become desirable. And such a station has been provided for in the present plan by raising the tunnel grade close enough to the street to permit of a high-level station for local service similar to that of Church Street.

Laguna Honda Station has been purposely located upon City property, which is fortunately situated at an intersection of important thoroughfares and which may be developed into a useful transit center for the upper San Miguel tract. In fact, this particular point lends itself so well to development that it has been chosen for a station site in spite of its elevation—considerably above the levels in the vicinity of Lake Honda. And the strategic advantages of this site are considered to so greatly outweigh those of the lower levels further west in Seventh Avenue that final choice has rested here, even though a motor-driven escalator may have to be used until such time as the trolley transfer arrangements herein proposed can be carried out. (Fig. 61.) Supplementing the escalator, however, an inclined walkway or ramp has been provided in lieu of stairways to permit comfortable access to this station from the west.

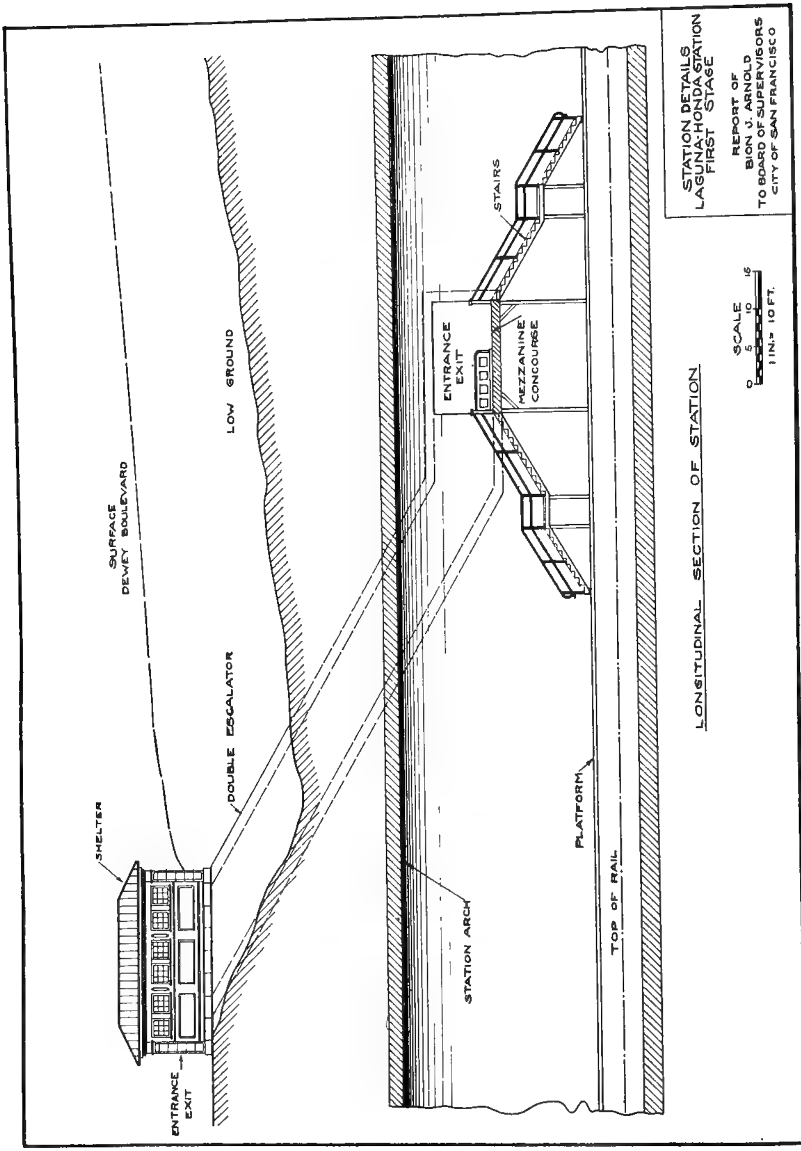


FIGURE 61—LAGUNA HONDA STATION, FIRST STAGE.

Arrangement of entrances by escalator and ramp for the first construction stage. Second stage detailed in Plate 15.

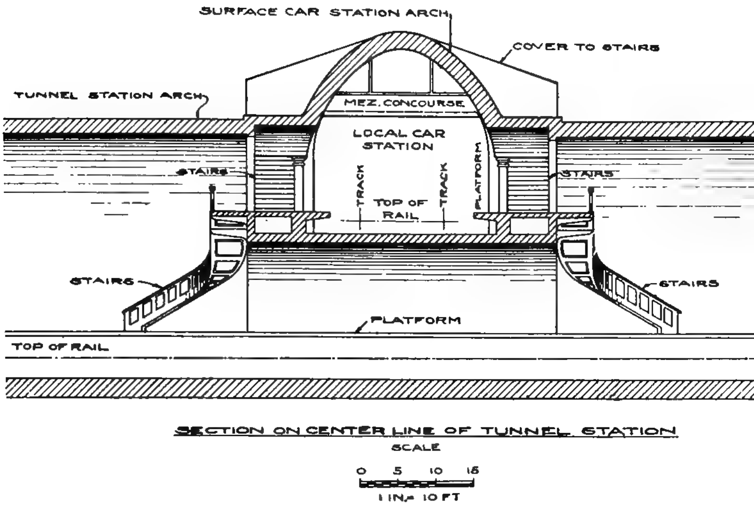


FIGURE 62.—LAGUNA HONDA STATION, SECOND STAGE.
Section on center line of tunnel, showing superimposed local car station of second construction stage. Direct transfer facilities.

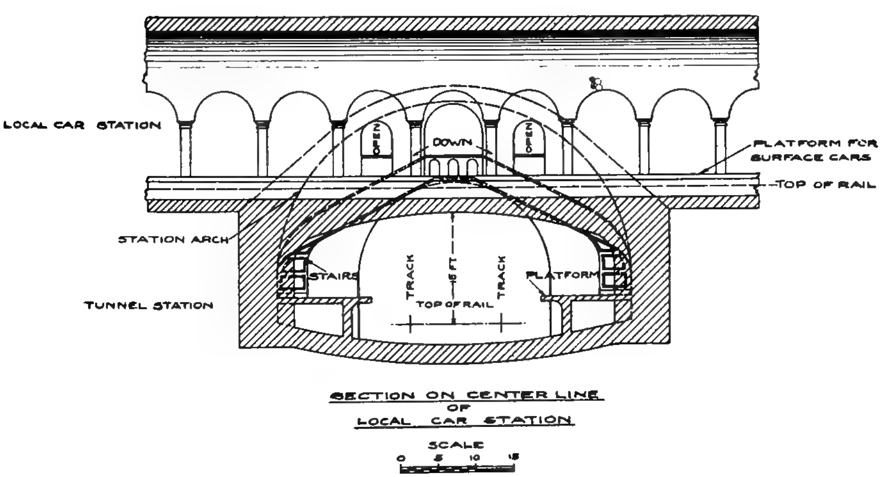


FIGURE 63.—LAGUNA HONDA STATION, SECOND STAGE.
Section on center line of local car station, second construction stage, showing direct transfer facilities.

Should the City determine to alter the grades or alignment of Dewey Boulevard or Seventh Avenue in this vicinity, every advantage should be taken to ease the approach grades and to decrease as much as possible the necessary depth of Lake Honda station at this point. In view of the cost of hauling all future trains up a grade exceeding three per cent, as compared with the slight disadvantages of an escalator, the present levels have been determined upon as the best compromise possible.

Development of Seventh Avenue Extension. The design for transfer connection at Laguna Honda may appear far more elaborate than the present condition of settlement of this territory would warrant. For this reason the construction has been separated into two projects—first, the station necessary for serving the tunnel only, and second, a super-imposed trolley transfer station running beneath Dewey Boulevard with inclined portals reaching the surface on both sides, this second project to be built as soon as the development of this territory warrants. (Plate 15.)

It is not too early, however, for the City to consider the improvement of roadways in this district, which must be based upon the prevailing contours. The southern end of Dewey Boulevard is manifestly impracticable. It is, however, entirely feasible to extend Seventh Avenue over the existing saddle between adjacent hills to Corbett Road, and if this is done the logical plan would be by means of an *open cut* running beneath the present bend in Dewey Boulevard in a southwesterly direction. In this event, this extension would take the place of the trolley station which has been designed as the second part of the Laguna Honda station. With the cross-town service through this open cut, excellent transfer facilities will be available for the development of surrounding territory.

Rolling Stock. The mistake must not be made in the design of a project of this magnitude of planning today for too small rolling stock. In other words, the tunnel clearances throughout must be ample to accommodate the *largest rolling stock that will probably be used.* It is true that for the first few years smaller rolling stock will be operated through the tunnel, viz., trolley cars nine feet wide by fifty feet long, and interurban cars possibly nine feet four inches wide by fifty-five feet in length and thirteen feet in height. But ultimately the time will come when standard high-speed multiple-unit trains will be in demand, which equipment may have to be *standardized with that of the Market Street subways.* Therefore, in the event that this high-speed equipment does not enter upon the city streets but *remains underground,* a much larger car would be possible. I therefore consider it necessary to provide tunnel clearances throughout which will accommo-

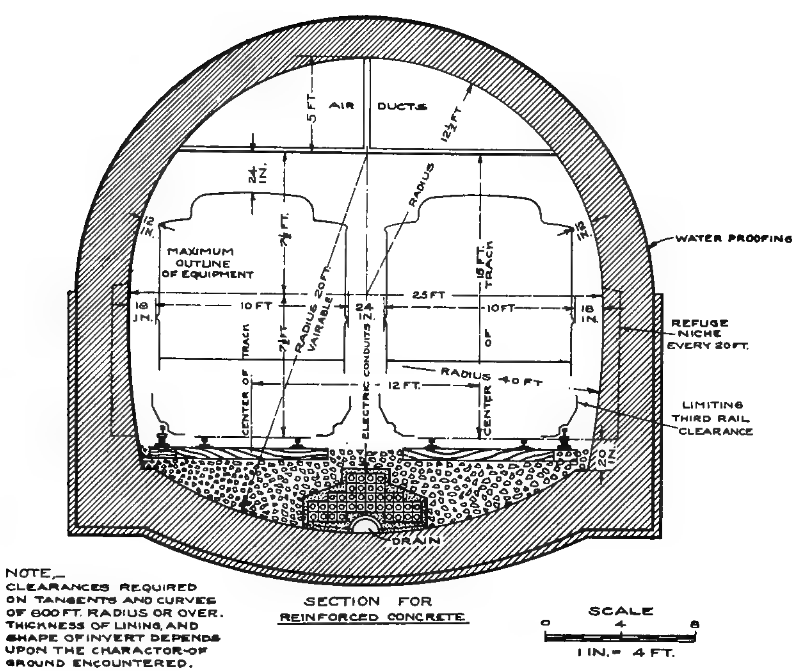


FIGURE 64 —TYPICAL ARCH ROOF SECTION OF RAPID TRANSIT TUNNEL.

To be used under the hill, showing maximum outline and clearance lines for rapid transit rolling stock. Thickness of lining and shape of invert dependent upon the character of ground encountered. Clearance lines shown are required on tangents and curves of 800 feet radius or over.

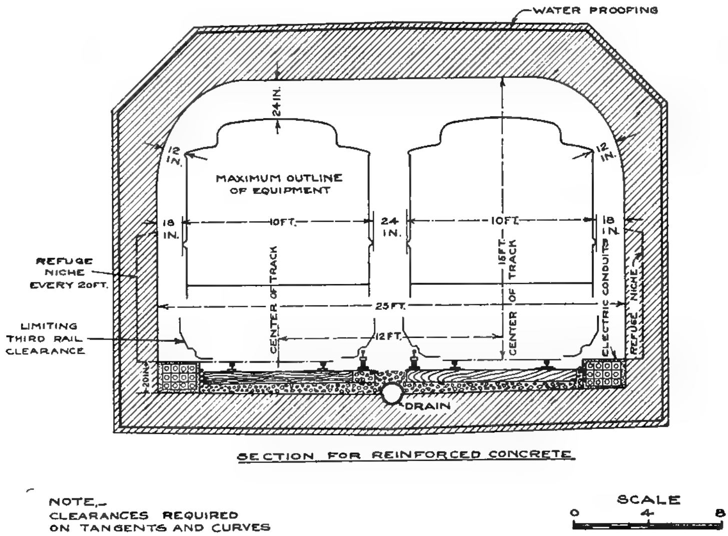


FIGURE 65 —TYPICAL FLAT ROOF SECTION OF RAPID TRANSIT TUNNEL.

Suited to Market Street. Clearances shown are required on tangents and curves of 800 feet radius or over.

date a car nine and a half feet to ten feet in width, sixty to seventy feet in length, and twelve feet in height, with a possibility of eight-car multiple unit trains operated during rush hours.

These clearances demand a tunnel bore about twenty-five feet in width, and the minimum height has already been defined in Part I as not less than fourteen and a half feet. In the single-arch section there will, of course, be ample head room; but in the shallow, flat-roofed section the overhead clearances will be minimum as stated, which height will be necessary to permit of trolley cars being operated through the tunnel for a few years until the rapid transit system is fully developed. Were the small cars alone contemplated, a tunnel section twenty-two feet in width would be ample, but if a tunnel were built of this size, there would be no hope of real rapid transit until the additional low-grade, two-track tunnel bore were built. *It is therefore real economy to provide now for the larger equipment.* (Figs. 64 and 65.)

Car Berths. With two types of equipment operated within the same bore, different heights of platforms will be encountered, also different body and step clearances, so that for the present, two level platforms must be provided, arranged in tandem, one to serve rapid transit equipment at the level of the car platform—approximately 3′ 6″ from the rail head, and the other for trolley cars at the level of the first step—approximately 15 inches. Rapid transit trains may then take the forward berth, and local cars, the rear berth, or *vice versa*. This condition necessitates longer platforms at the present time than would be necessary for standardized equipment, but the additional length will be equally useful when the platform is given over wholly to standard rapid transit equipment and traffic has developed.

Current Collection. Although the tunnel bore has been designed with head room sufficient at all points to permit trolley collection with a reasonable height of car, it is contemplated that all rapid transit rolling stock shall eventually be equipped for third rail collection. This applies not only to strictly subway equipment, but also to long distance interurban trains and possibly also to suburban expresses reaching points within the future settled portions of the city requiring rapid operation. Even though trolley collection may be retained for a number of years on the interurban lines, it will be distinctly advantageous to equip all motor cars for third rail collection within the tunnel in order to avoid interruptions and delays therein due to trolley troubles. For this purpose a type of collecting shoe may be used which will afford no serious obstructions when running along the street or highway.

It may be either of the raised or lowered type, held in contact by air pressure and released when the trolley is lifted.

In the sketches of tunnel sections appended, the standard clearance line for third rail collection has been indicated as established by the Committee on Electrification of the American Electric Railway Association, in conformity with the best American practice.

Utilities. Provision should be made throughout the tunnel for the accommodation of such utilities as are necessary in its operation, such as power cables, lighting cables, signal wires, fire line with hydrants and attached hose reel located at intervals in wall niches. It may be also desirable for additional conduits to be built into the floor or structure wherever practicable, for the purpose of renting by the City to other corporations or for its own system of electrical distribution as may be developed from its water properties. The space available for the extra utilities is limited, and if the tunnel bore were to be used for carrying bulky utilities through the hill, special provision would have to be made for this purpose over that shown herein.

All sections of the structure shown or recommended are for reinforced concrete, for with the combination of concrete and steel of various shapes are obtained the maximum strength with the minimum section for the least cost.

It is also more readily moulded into the many varying and complicated shapes required, and more impervious to moisture than any of the other materials available for this work.

Capacity of Tunnel. In so large an investment as here represented, every reasonable means must be adopted to secure immediate and continuous return. Were the tunnel of comparatively short length and the investment correspondingly small, it would not be advisable to consider the operation of two types of equipment, possessing widely differing characteristics in starting and running speeds, within the same bore. With this tunnel, however, the investment is so large that a combined use of the bore becomes necessary for the time being until future development, local and Peninsular, shall render necessary the construction of a supplemental bore to be devoted to high-speed service only. Fortunately, the standard trolley equipment of San Francisco is fitted with high-power motors, capable of a free-running speed of 23 miles per hour on the level, so that it is possible for this equipment to keep pace fairly well with the interurban equipment.

The capacity of the tunnel may be estimated, based upon the minimum safe headway which it is possible to operate with a given type of equipment. Considering the Geary Street cars as representative trolley equipment, it appears that local trolley cars

cannot operate closer to the expresses than about 185 seconds, assuming an express run direct from Church Street to the southwest portal at an average schedule speed of 25 miles per hour. With express cars passing locals at Eureka Valley and Laguna Honda stations, the trolley cars could follow at a minimum headway of about 80 seconds without interfering with the express schedules. In normal operation of this combination service, it would probably occur that if trolley cars were operating on less than a three-minute headway, it would be necessary to "bunch" trolley cars behind an express, in order to give the latter a clear track. Under these conditions, the capacity of the tunnel in cars per hour would be as follows:

Assuming an express schedule speed of 25 miles per hour, running on 15 minutes headway, it will be possible to pass through the tunnel 78 local cars† per hour, or 82 total, with no express stops between Eureka Street and the west portal. This means that the tunnel is kept entirely clear of trolleys at the time of express runs. As the express cars become more frequent, the maximum permissible cars per hour also decreases rapidly so that with a five-minute express headway, only about 68 cars per hour total may be passed through without interference. On the other hand, with no express service, about 85 cars per hour may be passed through the tunnel, under safe operating conditions, and using two-car stops as recommended for lower Market Street.

Four-tracking. The time to consider the construction of an additional two-track tunnel will have arrived when the possibilities of every device designed to reduce the safe headway has been exhausted. As the importance of express traffic increases, the proportion of express to local will be dictated by the necessities of the former, not the latter. By the exclusion of trolley cars, replacing them by high-speed tunnel cars giving shuttle line transfers, the time for four-tracking may be somewhat deferred. Further, by improvements in signaling from time to time the capacity of the bore may be further enhanced. It is more than probable that before the capacity of the bore is reached a continuation of the subway down Market Street to the Ferry will have become a reality, with branches into the Mission and Richmond and possibly upper Sunset. The necessity will then more than ever arise for the organization of the service upon an exclusively rapid transit basis with outlying feeders developed to the maximum extent. (Plate 16.)

Fare Collection. The method of fare collection at the various stations and at portals is dependent largely upon how much of the complete project is built now and upon the type of equipment

†With two-car stops.

operated through the tunnel. If only the hill section is constructed now, the present method of fare collection will probably suffice. And even if the entire project is constructed but trolley cars are run through the tunnel in considerable numbers, prepay fare collection on individual cars may still be desirable because of the complication ensuing in accounting between various lines using the tunnel if an entrance booth collection were used. Eventually, when only rapid transit lines use the bore, booth collection will have to be installed; but for the present it is believed that the prevailing methods of fare collection will suffice without excessively delaying the schedule.

There is ample opportunity for installing collection booths at all of the stations when traffic conditions warrant, without additional land being necessary. At Church Street, the entrance concourses may be extended east and west under Church Street within the street line. At Eureka Valley a single entrance can be developed in Diamond Street with exits at Eureka and Collingwood as now shown on the plans; or if a reservoir station is constructed at this location, (that is, permitting passing tracks for expresses and locals), prepay entrances can be developed at both ends, as well as exits. This question of fare collection, therefore, need not enter seriously into the present arrangements.

Ventilation. Provision has been made in the designs, (Plate 15), for forced ventilation, the crown of the single-bore arch being divided for this purpose, so as to provide separate ducts drawing air from different points in the bore. Although the installation of ventilating equipment may not be necessary during the early period of operation, provision for later installation should not be neglected now which would render an effective system difficult to obtain at such time as the tunnel traffic has become so extensive that natural ventilation becomes inadequate. The location of the Laguna Honda station at the summit with descending grades in both directions, offers a convenient opportunity for ventilation, especially as the station at this point, when completed, will constitute an open portal. The proportions shown herein are contemplated to provide a complete change of air within the bore every 20 minutes by mechanical ventilation alone. And the effluent is drawn approximately midway between portals so that fresh air is always entering at the portals. This is important in case of an accident and fire within the tunnel, when passengers would always have an opportunity of escape in the direction of the portals, facing fresh air.

Terminals. Any extensive development of Peninsular service will unquestionably require corresponding terminal development in the vicinity of the northern portal in West Mission Street. And

with adequate transfer facilities to present surface lines, it would be possible for such terminal to be made use of as a point of originating traffic without the necessity of the large interurban cars using Mission Street. There is much to be gained in this plan because of the high speed gear ratio that could be used on the terminal trains, whereas such a ratio would be undesirable for cars operated along surface streets with frequent stops. So that with the rapid transit lines operating in harmony with the surface system, every consideration of efficiency points to the desirability of developing a terminal near the northeast portal.

Here it is pertinent to point out that one of the chief arguments for extending the tunnel down Market Street at this time is to provide terminal facilities for peninsular and suburban lines operating *independently* of the present United Railroads lines. By emerging from the tunnel at Eureka Street no independent line can use the tunnel unless four tracks are installed the entire length of Market Street.

The McCoppin Street portal will be useful in this connection even after the extension of the subway down Market Street, as a convenient means of routing terminal cars out of the main bore. It is also well located with respect to storage of cars during non-rush hours—provided the land does not become so valuable as to preclude its use for this purpose.

Suburban Connections. The maximum usefulness of this rapid transit project will be derived by a system of feeders thoroughly covering outlying suburban territory, which deliver the long-haul passengers to the rapid transit line, rather than to attempt the passage of each local trolley line through the bore. This maximum usage will come when trolley cars are entirely excluded. On general principles, passengers do not object to transferring from local to express cars if the transfer is made convenient with cars running strictly on schedule, and there is anything to be gained in time. The development of these feeders is particularly important in the outlying districts southwest of the Twin Peaks ridge, and a number of suggested lines in addition to the present ones are shown in Plate 17.

Tributary Area. It is not generally realized how much habitable land exists in the territory which is to be regarded as tributary to this Market Street extension line. Leaving entirely out of consideration Eureka Valley and upper Market Street as tributary to this project, the contour map, Plate 17, shows:

First, the comparatively level land available;
Second, the areas of greater than 10% slope;
Third, the areas of greater than 25% slope,—

all within the region bounded by Lincoln Way and the Twin Peaks ridge. The shading on this map indicates that only a comparatively small area has vertical slopes of more than 25%, and even these are capable of being converted into desirable residence areas by means of the contour plan of street subdivision. This map shows clearly the extent of the middle valleys lying to the southwest of Twin Peaks in the San Miguel Rancho, the development of which has been one specific object of the Laguna Honda station.

Running Time. This map, Plate 17, also shows the possible running time from the central business district—Third Street—via the tunnel route, as compared with that of other existing surface lines. Moreover, only the local time of transit is shown, and not the express time. It will be seen that the ocean beach can be reached for some distance in 30 to 35 minutes, while 30 minutes is now consumed in reaching Ashbury Heights, half this distance. Northeast Sunset District may be reached sooner by transfer at Laguna Honda station to a proposed Seventh Avenue line than by the present line along Lincoln Way. However, this would not be the case were the Mission-Sunset tunnel built. The San Miguel tract may be reached within 20 to 25 minutes. Furthermore, a large part of Sunset is brought within the 30-minute time zone; and in the strip adjacent to the rapid transit line, the 30-minute time zone is extended as far south as Colma for local suburban service. These results illustrate the possibilities of development of desirable territory through adequate transportation.

Grade Separation. The alignment of this rapid transit line south of the south portal is indicated tentatively. (Plate 13.) For the present, it is contemplated that the line will reach present grade at the bend in Sloat Boulevard, thence paralleling the present surface tracks to Ocean Avenue (Plate 15), and thence by the best grade route down the Peninsula as may be determined by detailed surveys. All Parkside lines will route off from the main line at the southwest portal, and the remaining feeders should divert from the main line at Sloat Boulevard, using the present tracks on Junipero Serra Boulevard.

This condition, however, cannot last many years, and eventually grade separation at Ingleside will become a necessity. A suggested diversion of the main line from the southern portal to accomplish this grade separation is shown dotted in Plate 13, this alignment taking advantage of the higher levels to remove the reverse curve at present existing, and secure grade separations at Corbett Road and Ocean Avenue, and a depressed transit line through the upper Ingleside tract by open cut, about one block east of the boulevard—250 feet—thence crossing the lower Ingleside

tract to a continuous right-of-way either to the right or the left of the boulevard. And it is extremely important that the plans for the subdivision of this territory be so drawn as to *permit of this future grade separation* without destroying or damaging improved property. The depressed trackway can be carried through as indicated in Plate 15 without deteriorating adjoining property. An example of this may be found in the four-track open cut of the Brighton Beach Rapid Transit line in Brooklyn. This design will be even more attractive with grass slopes, although requiring greater width.

Subdivision of Land. In anticipation of transit improvements, a number of subdivisions are under way in San Miguel Rancho and vicinity, and it cannot be too strongly urged that these subdivisions be co-ordinated with reference to inter-connecting streets and transit facilities, instead of simply developing independently each particular parcel of property. The City of San Francisco is today suffering from the effects of subdivision regardless of contours. Here is a chance for improvement, and the City should not only refuse its approval of any subdivision which does not co-ordinate with those already perfected, but it should compel a proper subdivision to be made. The importance of this will be seen when it is appreciated that, by the contour method of subdivision, a considerable part of the area shown on Plate 17, above 25% in grade, and all of the area above 10% slope, can be rendered available for attractive residential territory. This matter is so important that it should be put in charge of a definite and permanent civic organization with power to act.

Disposal of Material. There are a number of good opportunities of utilizing to advantage the material excavated from this tunnel. The construction work would naturally divide itself into three parts:

First, the south section, between the portal and Laguna Honda station;

Second, the middle section, between Laguna Honda station and Eureka Street; and

Third, the north section, between Eureka Street and the north portal.

The material from the first section can be delivered by gravity to a fill across the gully paralleling Corbett Road, it being desirable to fill up this gully for some distance back to provide suitable residence land.

The material from the second and third sections can be delivered by gravity in the other direction, and all conveyed to the Islais Creek flats. The irregular area between Army Street and

Twenty-fifth Street could also be filled to grade advantageously in order to facilitate the extension of Potrero Boulevard down San Bruno Road. The excavated material may readily be hauled over street car tracks at certain times of the day and at night, under special arrangement with the railway company.

Requisition of Property and Easements. In providing sufficient property for carrying out this project, complete surveys have been made of the right-of-way by the City Engineer, and computations and descriptions of the property necessary have been prepared in connection with the City Engineer's office. This description covers sufficient property for the construction of the stations contemplated for the future as well as the present project.†

Mission-Sunset Project

The present plans in Eureka Valley district provide, in addito future reservoir passing tracks for expresses and locals, that the proposed Mission-Sunset traffic tunnel may be utilized also for the ultimate construction of a subway connecting the Eureka Street portal with upper Sunset, and following the same alignment as the traffic tunnel. And a design for this tunnel is herein shown, Fig. 66, which contemplates this improvement. Instead of building the original traffic tunnel of sufficient width for accommodating both

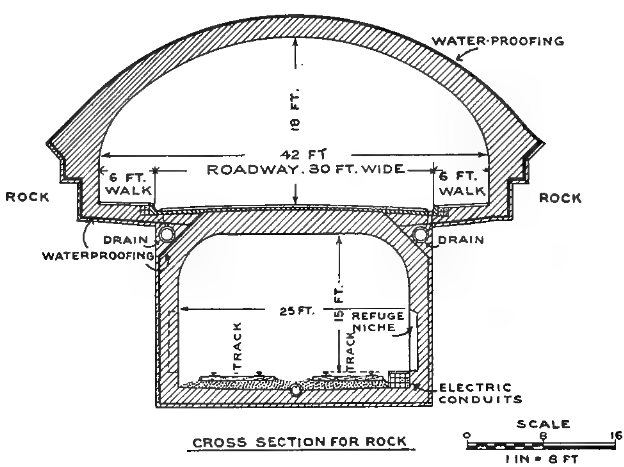


FIGURE 66—TYPICAL CROSS-SECTION OF MISSION-SUNSET TUNNEL.

Designed for construction *in rock*. Total width of bore, 42 feet. This may be erected in two stages if desired. Traffic tunnel, first stage; subway, second stage.

†This detailed description, although published in Preliminary Report No. 8, is omitted herein for the sake of brevity.

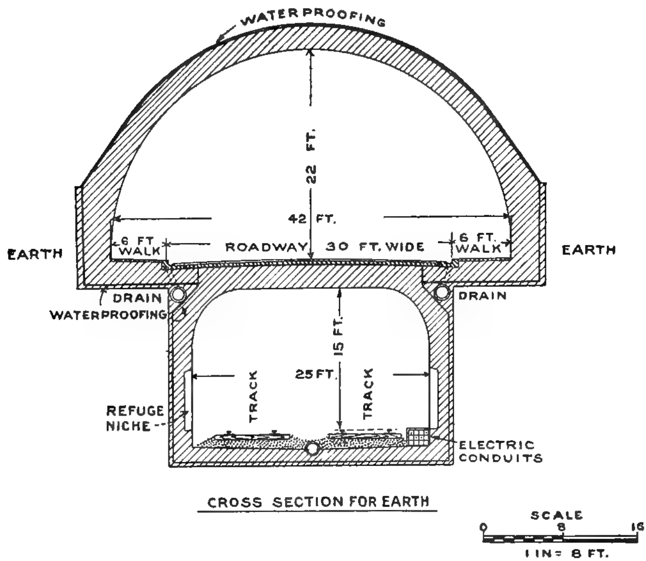


FIGURE 67—TYPICAL CROSS-SECTION OF MISSION-SUNSET TUNNEL.

For construction *through earth,* in two stages if desired. Total width of bore, 42 feet; 30 feet roadway.

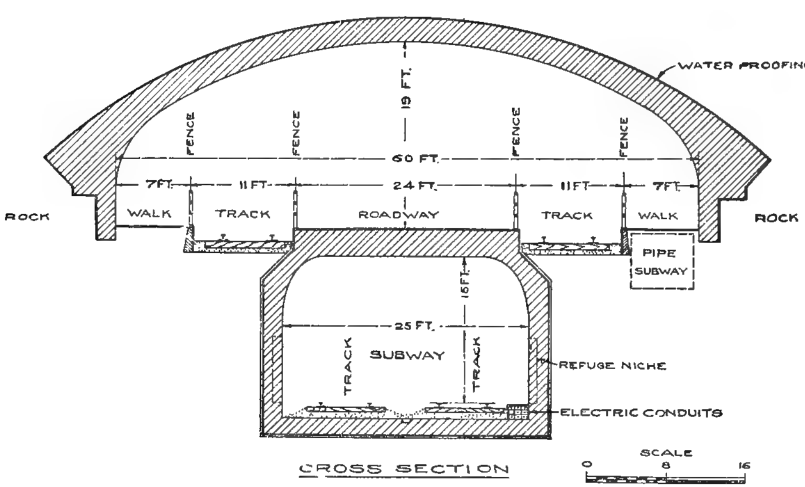


FIGURE 68—TYPICAL CROSS-SECTION OF COMBINED TRAFFIC-TRANSIT TUNNEL.

With provision for both surface and subway transit lines. Total width of bore, 60 feet; 24 ft. roadway. Corresponding to the design already submitted for the Broadway tunnel, except that the subway project is added.

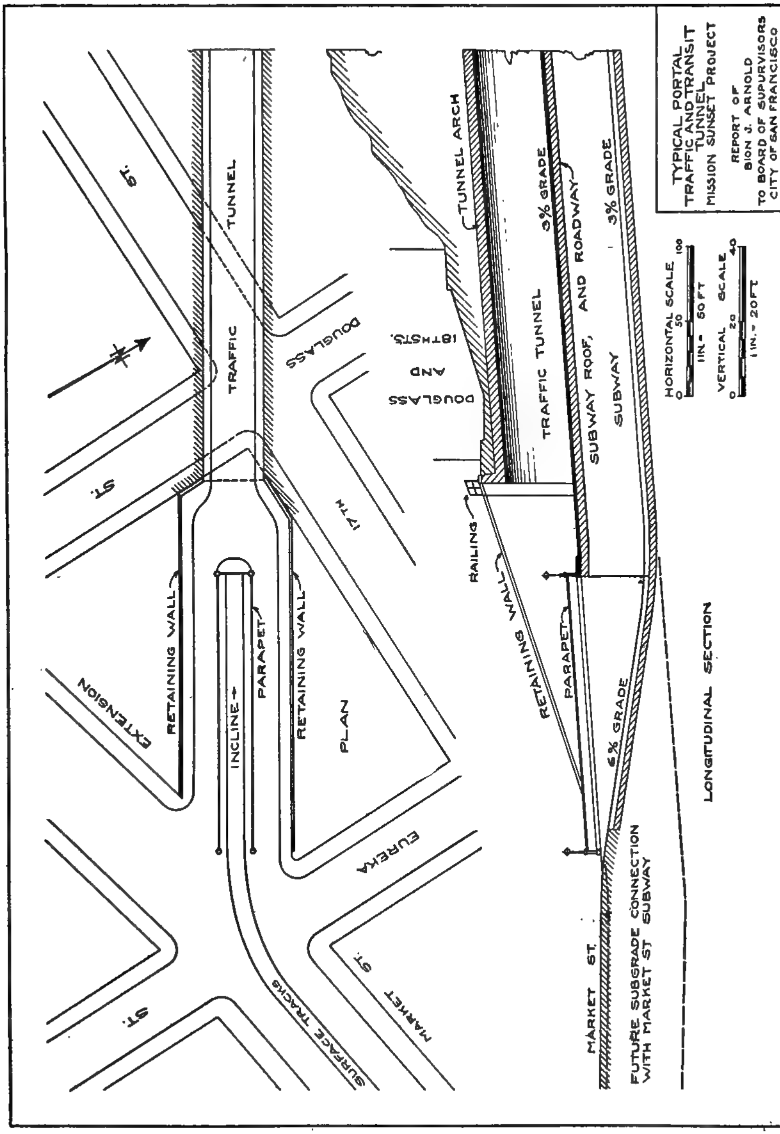


FIGURE 69—MISSION-SUNSET TUNNEL PORTAL.

Typical arrangement of combined traffic and transit tunnel, showing method of utilizing sub-grades for present surface cars and also for a future subway connection directly with Market Street subway bore.

traffic and car lines, the bore is narrowed to accommodate only vehicle traffic and pedestrians from surface to surface. Car lines are to be run at a lower level beneath the roadway. Up to the time that subway cars are required, this low-level bore may be reached by incline at each portal. Ultimately, this bore may be used by both subway and trolley cars, the subway tracks continuing to an intersection at subway grade with the Market Street line, and the trolley cars routing out to the surface at Eureka Street as before, or continuing through the Market Street bore as far as Valencia Street, until such time as the trolley cars will be entirely excluded from the bore. With this in view, the Mission-Sunset tunnel should be designed to accommodate subway car clearances.

Combined Traffic Tunnel. This section has the advantage of being suitable for construction in narrow streets. It will largely remove the element of danger arising from the possibility of the supporting thrust of the earth being removed behind the abutment in the event of excavation by private parties along the street line, which in the case of the wide span arch with abutments close to the street line would render the arch unstable. This reduced width of structure would obviate the necessity of acquiring easement rights in private property for the protection of the structure.

CHAPTER 12

STREET AND DISTRICT IMPROVEMENTS

Extensions, Widenings, Cuts and Fills
Supplemental Tunnel Projects

In connection with the development of an adequate transit system for San Francisco as outlined in Chapter 3, it is essential that certain improvements be made in the present street plan if the most effective distribution of service is to be promptly realized. The Burnham Plan is of great value in focusing attention upon the major problems of the future city plan, but with the exception of a few which possess unusual strategic value in the realization of a great future rapid transit system, the improvements here recommended will be comparatively inexpensive or of unusual importance. The relative urgency of these projects is dependent somewhat upon the developments of the near future, but they should all receive serious consideration in any study of a comprehensive transit plan. Certain tunnel projects additional to those already recommended in Chapters 10 and 11 are discussed.

RECOMMENDATIONS

1. Bernal Cut should be developed as a new outlet from the Mission for both rapid transit and vehicle traffic, and in connection with the improvement of Circular Avenue.
2. Market Street should be extended on the contour plan around Twin Peaks as a low-grade vehicle route, supplementing the Twin Peaks tunnel.
3. Van Ness Avenue should be extended to Mission Street, forming the intersection which will be the most important transit center in the city.
4. Hayes Street grade should be lowered at Alamo Square to re-establish direct car service to the district north of the Panhandle.
5. Noe Valley should be made more accessible by means of a short diverting tunnel on the Church Street alignment.
6. Kearny Street may be effectively extended by tunnel under Telegraph Hill, if the assessments do not prove excessive.
7. Recession of the projecting corner of Sacramento Street at The Embarcadero is imperative at least, if not a comprehensive plan of frontage equalization.

8. Potrero and San Bruno Avenues should be improved as a direct southern outlet from the business center.

9. Sansome Street regrade, to be effective, should include Broadway as far as Kearny Street and also Pacific Street.

10. Automobile stands should be provided on two or three sides of Union Square to avoid present vehicle congestion.

11. City traffic ordinances should be perfected and enforced so as to encourage rapid operation.

12. Park crossings have become an essential means of connecting Sunset and Richmond districts.

13. Sidewalk widths should be reduced at least along trunk lines, to preserve free way between cars and vehicles standing along curb.

14. Hillside property should be subdivided on the contour street plan in order to permit transit service.

15. Railroad grade crossings should be eliminated, especially across heavy traffic arteries, such as intersect the Southern Pacific line through the Mission.

16. Future subdivisions of level tracts should provide long blocks along streets occupied by transit lines, and short blocks transversely.

17. Central parking on wide thoroughfares combines attractiveness with rapid transit.

18. Ferry terminal development southward as well as northward will encourage the use of Mission Street and reduce Market Street congestion.

19. Berry, Division and Fourteenth Streets should be improved as a short route from The Embarcadero and Depot to the Mission.

20. Eventually Hayes ridge should be tunneled diagonally under Alamo Square, from Fillmore to Divisadero Streets, on the two-level plan.

DISCUSSION

Widening of Bernal Cut. Normal growth of the Mission district southward is arrested by the steep grades encountered on Mission Street between Cortland and St. Mary's Avenues. The traffic at this important throat is already so great that it has become necessary to increase the capacity at this point by opening a new thoroughfare for all kinds of traffic through the Bernal Cut (now owned and used by the Southern Pacific Company). The strategic position of Bernal Cut and its use as a rapid transit outlet have been presented (Chapter 3); but it is equally as important as an easy grade outlet for vehicle traffic from the several converging thoroughfares.

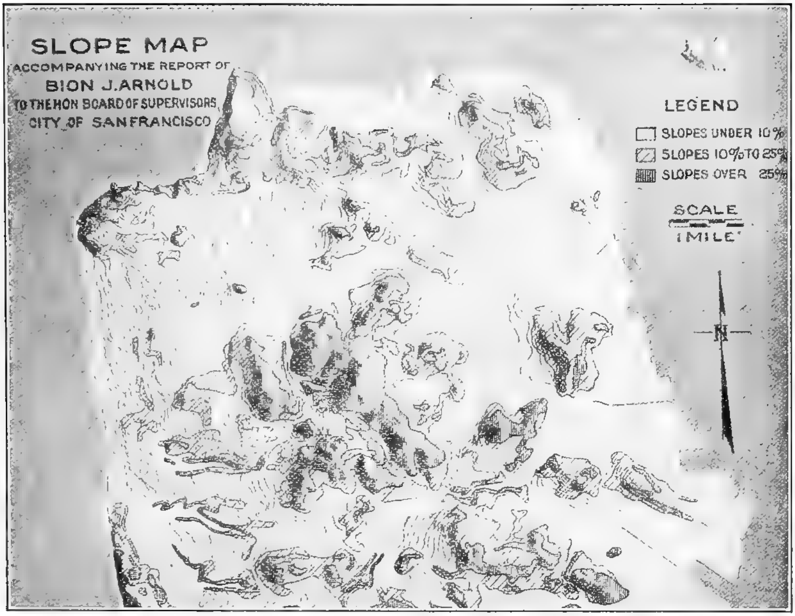


FIGURE 70—CONTOUR AND SLOPE MAP OF SAN FRANCISCO.

Prepared from a contour model of the city, with no streets shown, thus indicating the natural barriers to growth, the opportunity for diagonal streets, the few low-level passes existing, and the obvious necessity for tunnel construction. Successive levels may be followed by 20-foot contours, while all slopes over 10% and 25% are indicated by light shading and heavy shading respectively. Obviously these extensive areas of excessive slopes can only be developed by the subdivision of property so as to permit contour streets of easy grade.

Both Randall Street and St. Mary's Avenue cross the Southern Pacific line at grade, and the intervening cut is approximately 2300 ft. in length, with a right-of-way 100 ft. wide. By relocating Brook Street diagonally as shown in Fig. 18 and regrading San Jose Avenue between Brook and Randall Streets, a route can be secured from Mission Street to the Cut *with a grade of about 4%,* which is not excessive for trucking routes. This relocation is necessary not only to secure a more direct entrance to the Cut from Mission Street, but also to obviate the necessity for a "plateau" at the intersection, the addition of which would seriously affect the present Mission Street grades.

To secure ample width for vehicle traffic, Brook Street should be at least 70 ft. wide. While the present established grade through the Cut is suitable for track connections proposed, the depth of the Cut—46 ft.—renders it expensive to widen at grade

for roadways; so that the terraced plan (Fig. 71) probably represents the most practicable method for not over 4% approach grades. At the entrances to the Cut both tracks and roadway are on level, but at Randall Street, the first grade separation, some regrading is necessary to preserve vehicle freeway and headroom, which in any case would be desirable to preserve an easy grade approach *into the Cut* for vehicles. With this arrangement a minimum expenditure for retaining walls will be required, and the grades can be adjusted in such a manner as to equalize the cut and backfill. Sidewalks may follow the natural surface, but stairways to the street level should be provided from cross streets. Vehicles can return to Mission Street on St. Mary's Avenue, which is practically level. To extend the new thoroughfare, it will be advisable to use the alignment of the present right-of-way at least as far as San Jose Avenue.

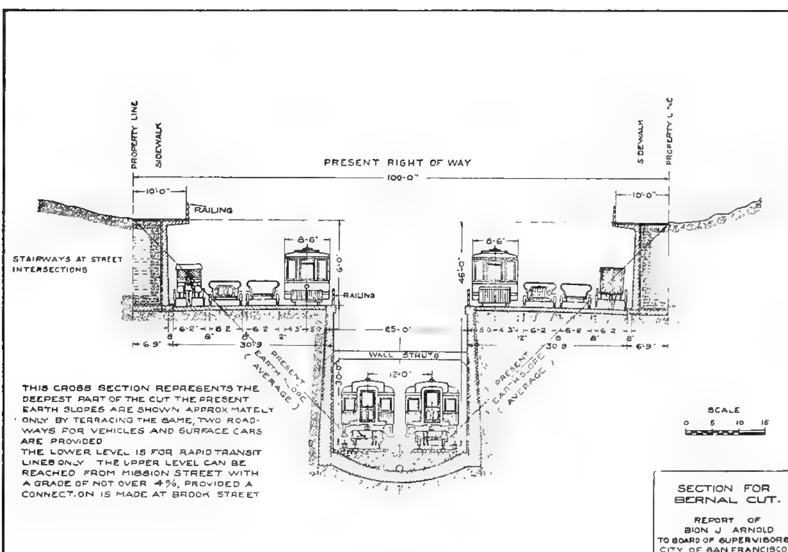


FIGURE 71.—DEVELOPMENT OF BERNAL CUT.

The joint improvement of the old Southern Pacific right-of-way through the Mission as a new low-grade outlet to the south centers in Bernal Cut and its logical extensions—Circular Avenue. This cross-section illustrates a plan for equalizing the cut and fill so as to provide separate levels for street and car traffic and for rapid transit lines. By the method of terracing shown a material saving in the cost of retaining walls will be effected, at the same time utilizing practically the full width of the present right-of-way—100 feet.

Improvement of Circular Avenue should be undertaken at the same time as a joint project by City and Railroad Company. The roadway should be extended along the right-of-way at least to Ocean Avenue, a strip of Balboa Park being used for this purpose. On account of the existing slopes, it is probable that the tracks may best be retained in their present alignment, and the Avenue developed entirely to the west.

Hayes Street Cut. In order to re-establish direct car service to the Hayes Street district north of the Panhandle, it is necessary to provide a lower grade between Pierce and Scott Streets. And by a cut of 15 ft. across the plateau at Pierce Street, the maximum grade may be reduced from 14.6 to 10.9% (See Fig. 72), which is within reasonable limits for electric equipment. If a terraced arrangement is used, with half the cut in the roadway and half in the walkway, the cost for retaining walls will be considerably less than if the cut is extended full depth between property lines.

Market Street Cut. The recommended location of the subway in upper Market Street will not interfere with the plan for improving the grade beyond Valencia Street. In any event, as a surface approach to the proposed Mission-Sunset tunnel the grade ought to be lowered to 4% between Waller and Buchanan Streets, and between Church and Sanchez Streets. This project will be the more necessary if the Twin Peaks tunnel is not built east of Castro Street.

Supplemental Tunnel Projects

In addition to recommendations already made on tunnels to Harbor View and under Twin Peaks, there are a number of other projects to be discussed, some of which are now or will eventually become necessary to the proper development of the city.

Telegraph Hill Tunnel. For some years this project has been discussed as desirable for both transit and traffic purposes, and the recent consideration that has been given to the possibility of locating the Marin County ferry terminal further north along the Harbor Front lends much weight to the possibility of this tunnel project. It is apparent, however, that any tunnel through Telegraph Hill, except for transit purposes alone, can directly serve only a comparatively small area between the hill and The Embarcadero, which will presumably be always devoted to manufacturing and warehouse purposes. Three locations have been considered: (a) straight extension of Montgomery Street; (b) straight extension of Kearny Street; (c) diagonal alignment from Kearny and Columbus to Powell and Chestnut Streets.

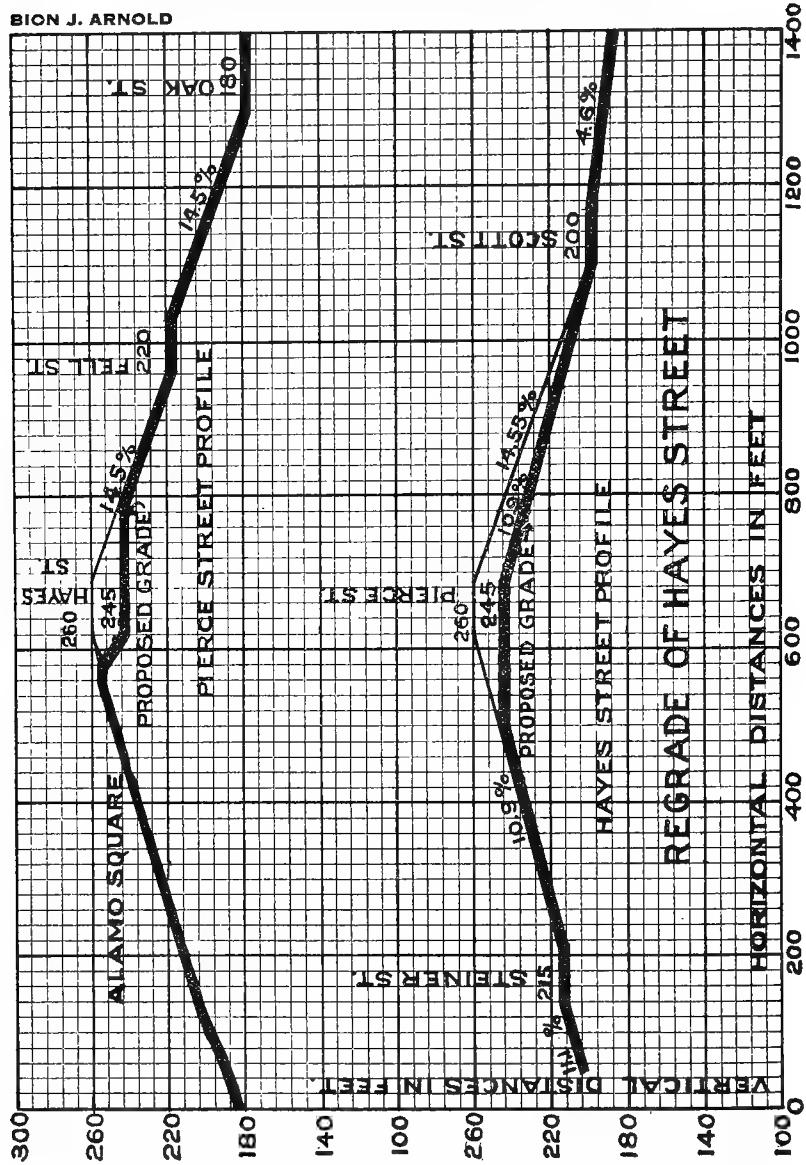


FIGURE 72.—PROFILE OF HAYES AND PIERCE STREETS.

Hayes Street Hill now imposes an impossible barrier to direct car service to the Park as was provided in the days of cable operation. These two profiles show the present grades and the grade changes recommended. A reduction of 15 feet at the top of the hill will change the grade on Hayes Street between Pierce and Scott Streets from 14.55% to 10.9% thus making possible the operation of cars between Fillmore and Divisadero Streets. By breaking the grade of Pierce Street, considerable regrading may be saved.

The Montgomery Street alignment I believe to be impracticable, because it is only one block from Sansome Street (a through car line) and only two blocks from Battery Street (a level trucking route), but principally for the reason that Montgomery Street is *too narrow* for any conceivable use as a thoroughfare for heavy car and vehicle traffic. The long diagonal alignment, while reaching a much larger level area on the north side of the Columbus Avenue saddle, presents the objection of an expensive structure nearly paralleling Columbus Avenue, which is already suited to cars and light vehicle traffic.

The Kearny Street extension is in my judgment the most practicable alignment, giving a direct thoroughfare from the center of the city to the north waterfront midway between car lines now established. Starting at the important intersection of Kearny, Columbus and Pacific, the bore would pass *under* Broadway, emerging at Chestnut Street, where street widening and portal improvements would have to be undertaken. The bore would be about 2700 ft. long, with a grade of 0.66%. At the north end there are complications with the Belt line tracks which must be dealt with, and at the south end heavy traffic would have to be diverted down Columbus, Pacific, and Jackson to Battery, or great congestion would ensue in crossing Market Street at Kearny. Pacific Street offers the most level diversion for this heavy trucking.

If this tunnel were built by assessment, it is clear that owing to the small area served the assessment would be heavy, but it is also clear that with the increased usage of the north waterfront, its importance would be greatly enhanced. This project, therefore, seems largely a question of cost.

Noe Valley Tunnel and Cut. In connection with routing studies, a tunnel reaching Noe Valley from the north has developed possibilities. It is now necessary to go as far south as Army Street before an entrance grade below 10% is obtained. This condition could be improved by a one-block tunnel for both cars and vehicles in Chattanooga Street, as shown in Fig. 73, *contingent upon* the possibility of the City's acquiring some private property necessary, and reserving for car lines a depressed strip along the west border of Mission Park. The tunnel will make possible a through car line on Church Street, connecting Fillmore Street and the Bernal Cut, and will also provide an easy grade connection with the upper Mission district by way of Twentieth Street. The legal obstacles pertaining to the use of Golden Gate Park for transit purposes will probably apply to Mission Park also. The slight reduction of park area is of small importance compared with the necessity for a car line on Church Street.

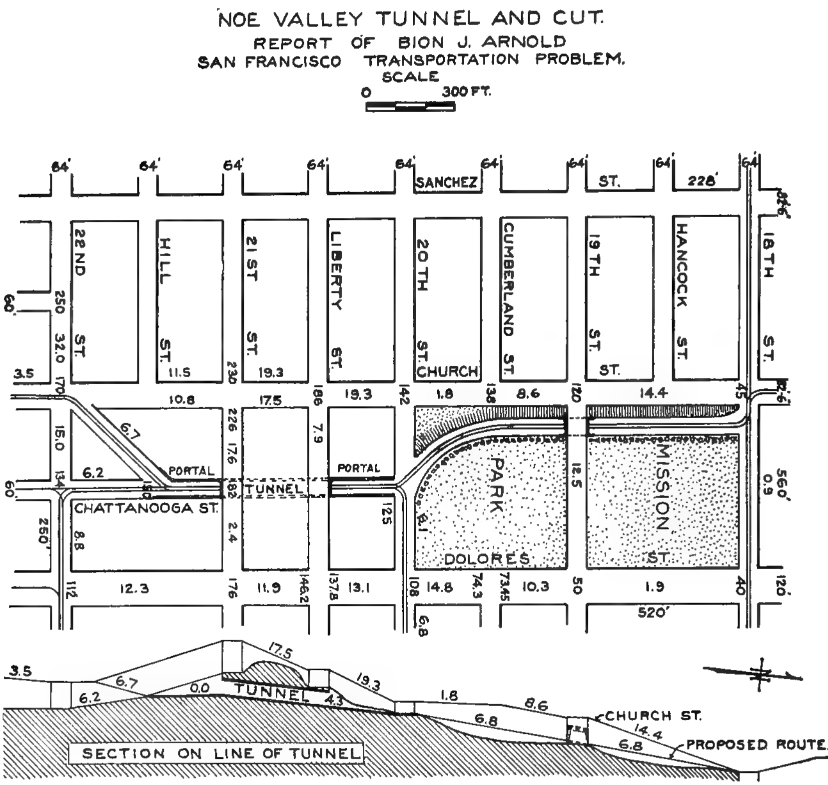


FIGURE 73—NOE VALLEY TUNNEL AT CHATTANOOGA STREET.

The tunnel work necessary in any case to extend a car line along Church Street into Noe Valley can be materially reduced by a slight diversion around the hump at Twenty-first Street. Some regrading along the westerly border of Mission Park and the acquisition of some private property will be necessary, but a good grade will result. The possible street railway connections to the main line on Church Street are indicated.

Folsom Street Tunnel. Of the several tunnel projects proposed through Bernal Heights none at present appear feasible. It is true that the upper slopes could be reached with the assistance of a viaduct across Army Street, but a comparatively small area is served in the end, and this route cannot hope to become an important outlet down the Peninsula as compared with the improvement of Bernal Cut as elsewhere discussed. Moreover, the hill property would logically have to bear the greater part of the assessment unless the route were extended by another long and expensive viaduct into University Mound, which would require also street widening through Bernal Heights, where the streets are now *only 40 feet wide*. The Heights is now served from the Mission

throat, and can be reached from the north side also by a car line. The improvement of Bernal Cut, San Bruno Avenue and Islais Creek Valley offer greater immediate opportunity than these tunnels.

Twentieth Street Tunnel. A tunnel on Twentieth Street has been proposed extending beneath Potrero Hill. While Twenty-second Street from Potrero Avenue to Mississippi Street offers a more favorable location, by saving about one-third of the length, both seem to me unwarranted at present, although the future East Water-front development may finally justify the expenditure. First attention should be directed to widening Army Street.

Tunnel Under Alamo Square. A diagonal alignment from Fillmore to Divisadero Street under the Hayes Street ridge offers an excellent low-level route direct from the business center and Fillmore Street to the Panhandle district. The length including approaches will be 2268 ft., and the grade 3.13%. As this bore may be used as part of a future subway system, the two-level cross-section designed for the Mission-Sunset project is recommended (Figs. 67 and 68).

Vehicle Widths. Measurements of a large number of motor and other vehicles show the following average widths, based on over-all measurements at typical street intersections such as Sutter and Polk, and Sutter and Montgomery Streets:

	Narrow	Medium	Wide
Automobiles	5′-3″ to 5′-9″ Runabouts and light touring cars.	5′-9″ to 7′-2″ Large touring and business cars.	7′-2″ to 9′-10″ Auto trucks and sightseeing autos.
Wagons	5′-6″ to 6′-0″ Buggies, hacks and single deliveries.	6′-0″ to 7′-3″ Double deliveries, ice and coal. lumber, produce and light drays.	7′-3″ to 8′-10″ Heavy trucking, low gears, beer and garbage wagons.

The resulting weighted averages* are 5′ 10½″ at Sutter and Montgomery Streets, and 6′ 2″ at Sutter and Polk Streets; these widths have been used in the studies of street sections.

Street Sections. Special emphasis has been placed, in discussing the design of cars, upon the essential provision of freeway for at least one line of moving vehicles between the car and vehicles standing along the curb. Fig. 75 illustrates the extreme necessity for this method of facilitating rapid passenger transit. Roadways are already too narrow, and to make matters worse the majority of business streets are not provided with rear delivery.

* True numerical average, giving proper weight to each type of vehicle according to the number of times it appears.

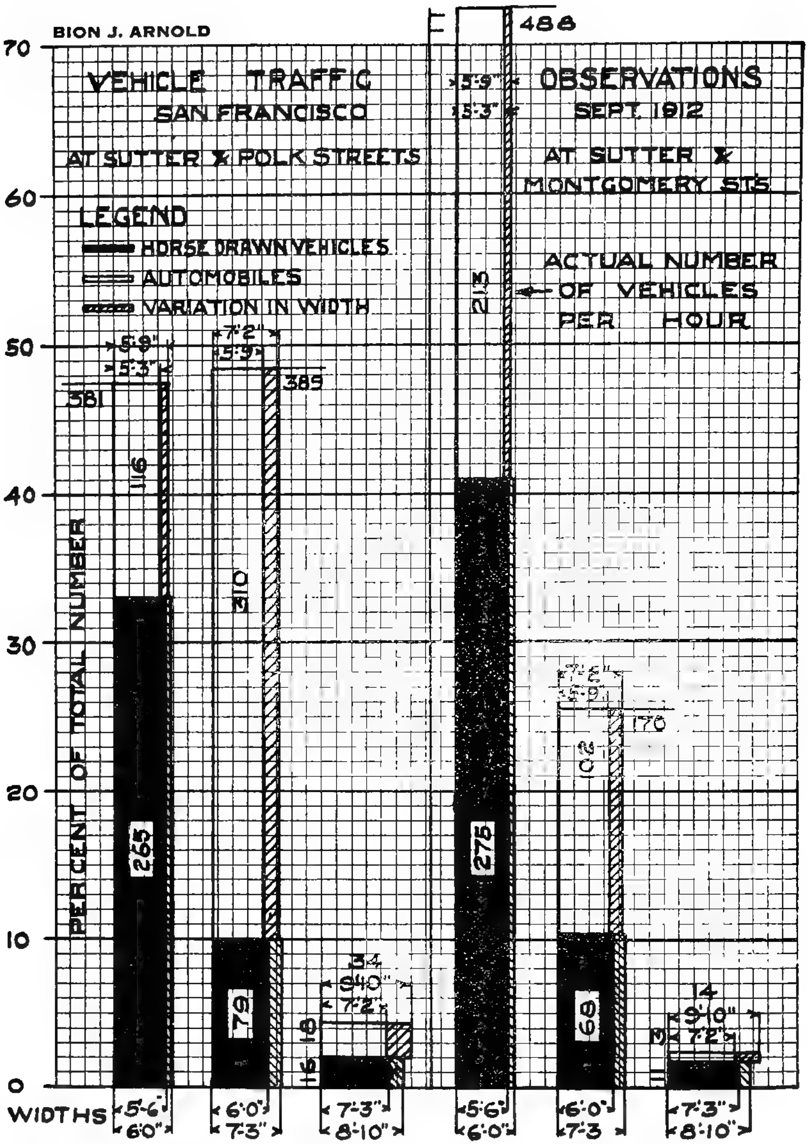


FIGURE 74—VEHICLE TRAFFIC OBSERVATIONS.

To determine the average width and character of vehicles actually found on the streets, observations were made at typical street intersections, viz.: on Sutter Street at Polk and Montgomery Streets, during the busiest period of the day, totaling nearly 1,500 vehicles per hour. While about half were motor vehicles, in each case the wider vehicles predominated in Polk street, indicating its use as a heavy traffic thoroughfare. Giving due weight to the number of vehicles of various classes actually observed, the width of the average vehicle at Polk and Sutter Streets was found to be 6′ 2″, and at Montgomery and Sutter Streets, 5′10½″. This lends special significance to the necessity of immediate reduction of sidewalk width.

LARKIN STREET, NORTH TO HARBOR VIEW.

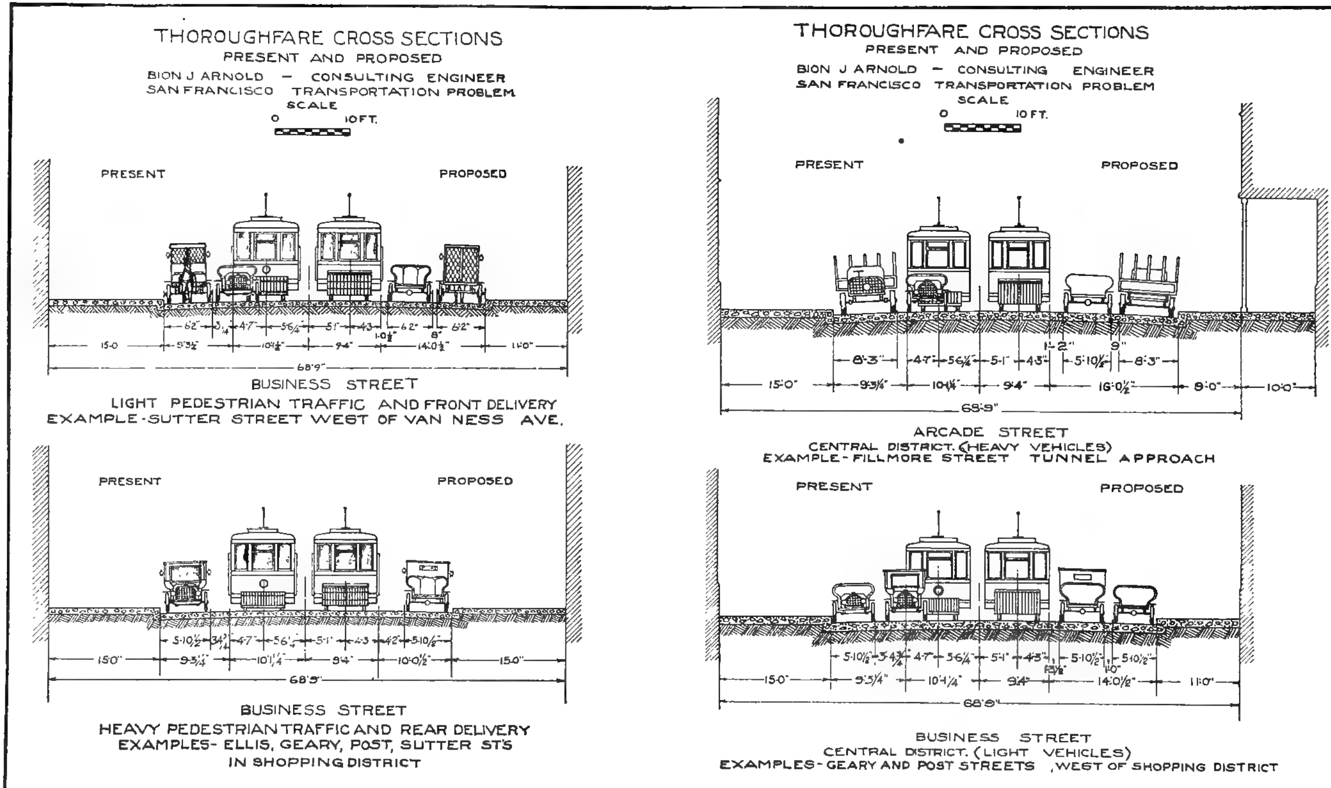
SUTTER STREET, BEFORE WIDENING.

EFFECT OF SIDEWALK REDUCTION.

SUTTER STREET, AFTER WIDENING.

FIGURE 75—PRESENT CONDITION OF THOROUGHFARES

The impossibility of using the narrow streets of the 50-Vara district for heavy vehicle traffic and rapid transportation at the same time, without sidewalk reduction, is evident from these views. It is for this reason that every effort has been exerted in car design to reduce the width of roadway required for car operation so as to provide free way for vehicles between cars and vehicles standing along the curb as indicated above.



FIGURES 76 AND 77—TYPICAL THOROUGHFARE CROSS-SECTIONS EXISTING AND RECOMMENDED.

These sections illustrate the fundamental defect of streets too narrow for rapid car operation, and the great necessity for adopting the Chicago standard of cars and track centers and also narrowing the sidewalks in order to provide free passageway for vehicles moving between cars and vehicles standing along the curb. Owing to the absence of alleys in San Francisco, rear deliveries generally become impossible. For streets where both wide sidewalks and additional roadways are necessary, the arcade plan is recommended, which is readily applicable, for example, to Fillmore Street, near the proposed tunnel portals.

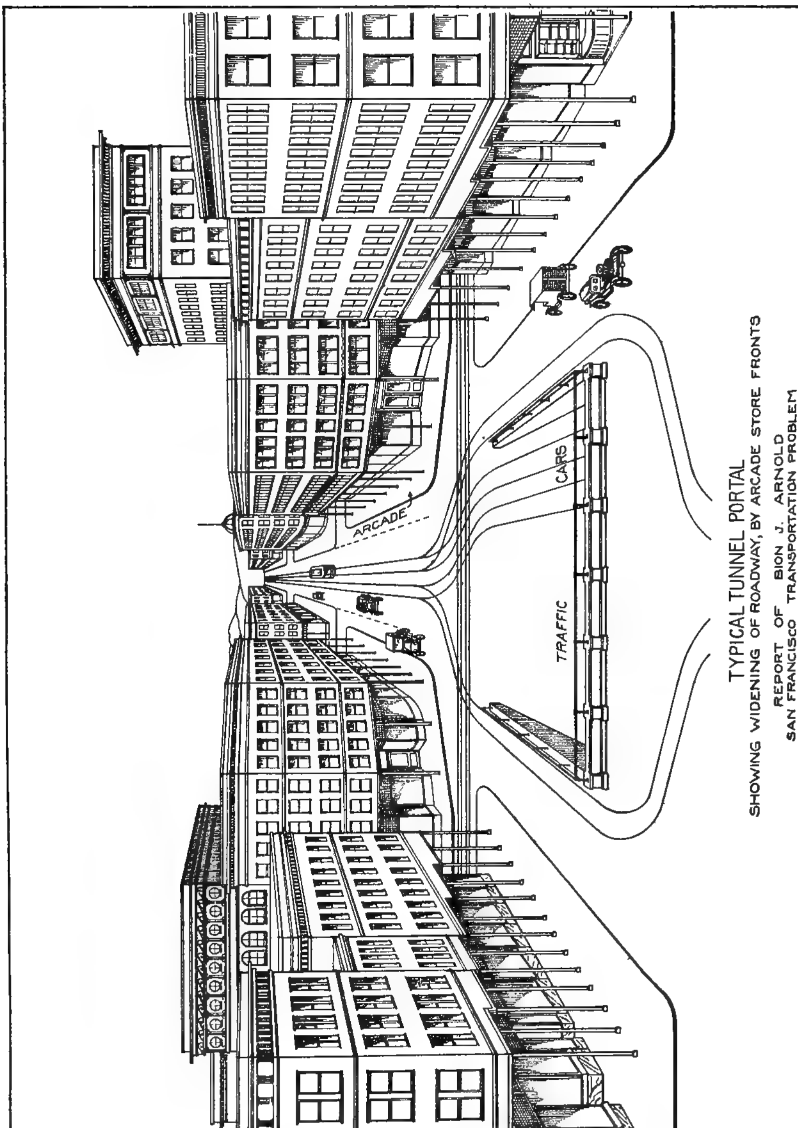


FIGURE 78.—PERSPECTIVE OF ARCADE STORE FRONTS AND TUNNEL PORTAL

A roadway of only 38′ 9″ at so important a tunnel entrance as Fillmore Street is clearly inadequate for both car and heavy vehicle traffic that must use this tunnel. This drawing shows an effective method of street widening at tunnel entrances with minimum alteration in abutting buildings and without recession of the building frontage. The arcading principle is widely used abroad to overcome just such a defect in street plan as exists here.

For the average business street the section shown in Fig. 76 applies, requiring a considerable reduction in sidewalk width. In the 50-Vara district, the sidewalks on a number of streets (Ellis, Eddy, Turk, McAllister, etc.) have already been reduced; and this work, now covered by ordinance, should be continued. A list of recommended changes is appended (Table 32).

Upon streets where all traffic is heavy, such as tunnel approaches, there is no recourse but widening. However, this work can be most economically effected by arcading the store fronts in the manner shown (Fig. 77) and the perspective (Fig 78) representing Fillmore Street south of the tunnel portal. Here the effect of street widening is obtainable with the same building lines.

Automobile Stand. Stockton Street is two feet and Powell Street one foot narrower than the usual streets of the 50-Vara district; and considerable traffic congestion is caused in this vicinity by sightseeing and other autos for hire. Fig. 79 is a plan for a stand for these vehicles at Union Square. By narrowing the sidewalks

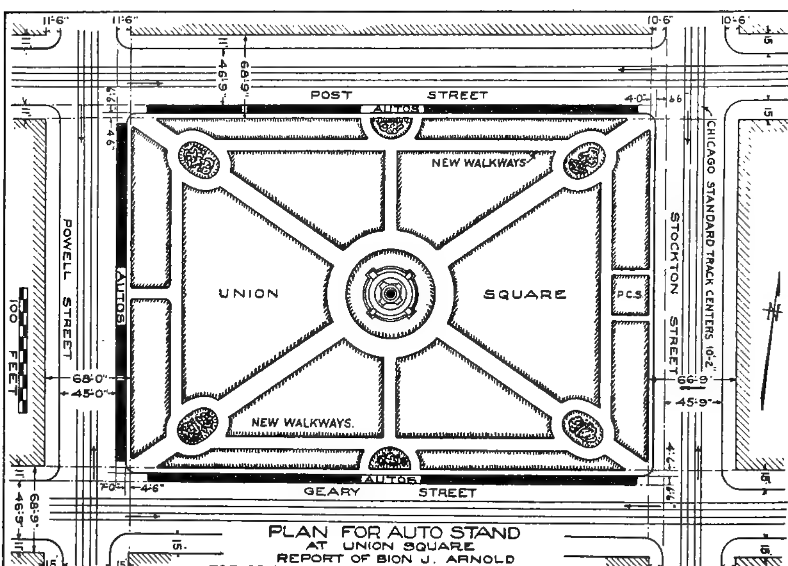


FIGURE 79—AUTO STAND AT UNION SQUARE.

The blackened area represents the space recommended for this purpose. New walkways within the park will compensate for the proposed reduction in the width of the present walks, while the width of roadway is preserved; or the park frontage can be receded 6½ to 7 feet as an alternative. The development of a hotel center on Union Square and the construction of the Stockton Street tunnel, which is two feet narrower than the standard 50-Vara street. necessitates some provision for automobile storage.

as indicated, these vehicles can be placed *inside the curb lines* proposed for the adjacent blocks. New walks within the Park may be provided as shown, or the present sidewalks moved inward. On account of the tunnel traffic anticipated the Stockton Street side of the Square should not be used for this purpose, but the sidewalks should be reduced nevertheless to secure additional roadway.

Street Widening

The Embarcadero. The recession of the projecting corner of Sacramento and East Streets should be immediately undertaken, whether or not the more ambitious plan of equalization of frontage is taken up as outlined in Chapter 13. This project has been presented on several previous occasions, but defeated owing to circumstances in which its merits were not the determining factor. But in view of the probable harbor development and the resulting increase in the value of the property involved, serious consideration should be given at this time to the equalization project. Block D is particularly unfortunate, in that it converges eastbound traffic at the most undesirable point, viz., opposite the ferries and cabstands. This congestion is rapidly becoming more and more acute.

Army Street should be widened to 100 ft. east of Potrero Avenue, because of its importance as a cross-town thoroughfare. It is the only level street south of Sixteenth Street connecting the Mission district with the waterfront.

San Bruno Avenue should be straightened and widened to 100 ft. from Army Street at least to Crescent Avenue. Although only 60 ft. wide, it is the principal thoroughfare connecting the Mission district with the region lying south and east of Bernal Heights.

Leese Avenue (formerly Holly Street) will provide a most direct route from the Mission district to University Mound. It is now less than 45 ft. wide and should be widened to 70 ft. or more when the street is extended to Silver Avenue and Cambridge Street by viaduct over Islais Creek.

Entrance to Sunset District. In recommending the alignment for the Mission-Sunset tunnel, the westerly portal was located at Frederick and Cole Streets, but with the expectation that so important a thoroughfare as a tunnel should be accorded the right-of-way through the narrow entrance throat to the Sunset district between Golden Gate Park and the northerly slopes of Blue Mountain. Of the three streets available at this point—Frederick Street, Carl Street, and Parnassus Avenue—only Fred-

erick Street provides a low-level entrance to the Sunset district at this point. Therefore, in the not distant future, it will become necessary to abandon the blocks intervening between Frederick Street and Golden Gate Park, with the object of directly extending Lincoln Way to Stanyan Street, which may possibly be done by an exchange of frontage, at the same time widening the throat.

Improvement of Division Street. Division Street between Ninth and Eleventh Streets is but 50 ft. wide. But the City owns considerable property in this vicinity forming the old Mission Creek bed, and this may be utilized, in part at least, to widen this thoroughfare, and provide connections with Twelfth and Fourteenth Streets on the west and Berry Street on the east and thus to The Embarcadero.

Street Extensions

Van Ness Avenue. Two plans for street extension in the vicinity of Twelfth and Market Streets have been proposed: (a) Mission Street extended to Market Street, opposite the intersection of Page and Franklin Streets; (b) Van Ness Avenue extended south to the intersection of Twelfth, Mission and West Mission or Otis Streets. Of these two plans, I consider the latter much preferable and an urgent necessity while the value of improvements on the intervening property is practically negligible. Owing to certain transit developments in this particular district, this intersection will unquestionably become the most important transit center in the City, especially by reason of the radial street plans in this vicinity. Direct routing to Harbor View from the Mission has even now created the demand.

Contour Extension of Market Street. As previously recommended, the extension of Market Street around the slopes of Twin Peaks and into Corbett Road is necessary to supplement the rapid transit tunnel project, and should be carried out *while the property is relatively inexpensive.* Its alignment and grade should correspond to that of the tunnel as far as Eureka Street, and then continue by such route as will give the most favorable grade without sacrificing directness. The thoroughfare could be reduced to 85 ft. beyond Eureka Street, with sidewalks not over 12 ft. in width. On the hillsides a two-level method shown in Fig. 80 may be employed to advantage, giving a wide street with minimum cut and fill. In the Punnett Plan for improving the Twin Peaks District, it has been suggested that the proposed extension should join Falcon Avenue just south of Romain Street. In that event the widening and extension of Falcon Avenue to Corbett Avenue and the widening and straightening of Corbett Avenue would become part of the project.

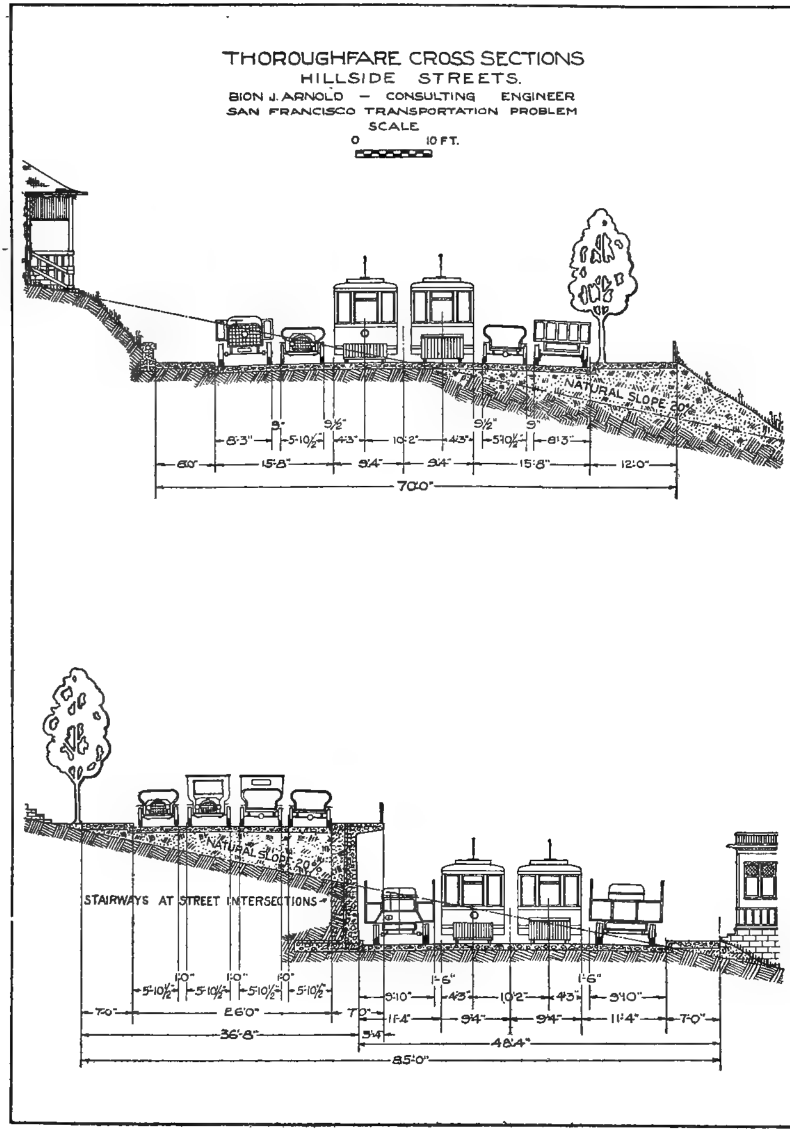


FIGURE 80—HILLSIDE STREET, PLANS A AND B.

The development of contour streets of reasonable width frequently necessitates terracing. These diagrams show two methods of treatment by equalizing cut and fill. With the usual method of grading as shown above, abutting property is either considerably above or below street grade; but by the use of a retaining wall in the center as in the lower diagram, all property is on the street level and an opportunity is provided for separating various classes of traffic.

Jefferson Street Waterfront. In view of the difficulty in securing an unobstructed entrance through Beach Street to a tunnel under Fort Mason previously recommended, the alternative development of Jefferson Street from Columbus Avenue under Fort Mason to the intersection of Beach and Laguna Streets may be adopted. As Jefferson Street is now under water, the excavation from the Fort Mason tunnel could be used effectively for filling and improving the waterfront.

Removal of Cemeteries. If definite steps are taken to open the five cemetery tracts within the city limits for residential purposes, Sutter Street should be extended to Euclid Avenue by a new contour street presumably passing to the south of the intervening hill. This would permit the remaining areas to be developed freely on the contour street plan. Incidentally, St. Josephs Avenue, now 100 ft. in width, could be relocated to advantage possibly as an extension of Baker Street. It is now of little value in that it is only 100 ft. distant from Broderick Street, upon which all the buildings front, so that the cemetery tract when improved would have to face the rear of these buildings.

Eighth Street. Should be extended in the near future from the intersection of Townsend and Division Streets through two intervening blocks to Fifteenth Street. The provision for this extension is quite evident from the fact that Blocks 134, 167 and 201 already fall in line with the western property line of Eighth Street. At the present time, the improvements upon this intervening property are relatively inexpensive. This district could therefore be provided with a direct thoroughfare from Market Street and the Civic Center to Sixteenth Street, which is the most important east and west low-level thoroughfare north of Porto Hill. Moreover, the importance of this route is enhanced by the construction of the Southern Pacific overhead viaduct on Sixteenth and Kentucky Streets. Eighth Street appears to be the only remaining street perpendicular to Market Street which can be cut through to the Potrero without excessive expenditure for the intervening property, and will be of great value in facilitating direct transit service.

Berry Street. It is most important that Berry Street be entirely relieved of its present encumbrances from Third Street to The Embarcadero, thus giving a direct trucking street from the warehouse and manufacturing district at the north end of Potrero Hill directly to and around the waterfront. This street is also needed as an exit for freight deliveries from the Southern Pacific yards, and especially to the lower Mission through Division Street.

Potrero Avenue and Twenty-sixth Street. Potrero Avenue, occupying an important position as an outlet thoroughfare to the south,

has a width of 100 ft., a grade of not over 4½%, and leads directly into the gap between Potrero Hill and Bernal Heights. But it will lose much of its importance as a thoroughfare until extended south to connect with San Bruno Avenue and the important cross-town route—Army Street—intersecting at this point.

Ocean Avenue from Onondaga Avenue to Mission Street is not open to public use, although existing upon the official maps. It should be developed as a thoroughfare for transit service via Mission to the Beach.

Dolores Boulevard. In connection with the improvement of Bernal Cut, Dolores Boulevard should be extended to Mission Street, thus diverting from the latter thoroughfare a portion of its traffic.

New Streets. On account of the steep grades on Crescent Avenue between Bache and Banks Streets, it is recommended that a new contour street be laid out continuing westerly the lower portion of Crescent Avenue parallel with the Ocean Shore Railway to a point in the old St. Mary's College grounds, there connecting with Bosworth Street, St. Mary's Avenue and Leese Avenue (formerly Holly Street). This new thoroughfare, which might be appropriately named Islais Avenue, would be available for car lines.

A new street should be developed extending from Bosworth and Lyell Streets to San Jose and Diamond Streets, and parallel with the Southern Pacific right-of-way. This will provide a direct outlet to Mission Street of both the San Jose Avenue and Sunnyside Avenue lines, also connecting with the proposed new contour street (Islais Avenue) mentioned above.

By following a ravine running diagonally from Woolsey Street tc Wayland Street, a good grade will result, for lines serving University Mound from the east.

For Car Line Extensions

Falcon Avenue from Twenty-third Street to Corbett Avenue.
Capp, Howard and Treat Streets to Army Street.
Capp Street to Fourteenth Street.
Alpine Street to Tilden Street.
Randolph Street to Junipero Serra Boulevard.
Pierce Street to Hamilton Square.
Twelfth Street to Division Street.
Fourteenth Street to Division Street.
Ninth Avenue through City property to Forest Hill.
Taraval Street to Twin Peaks tunnel portal.
Vicente Street to Twin Peaks tunnel portal. (Alternative.)

Wolfe Street to Montcalm Street (contour street).

Brewster Street to Powhattan Street (contour street).

General. A number of further street extensions, while perhaps not essential for transportation, are nevertheless desirable.

Waller Street. Through Buena Vista Park to Buena Vista Terrace, at an average grade of 3.4%.

Seward Street. From Danvers Street to Eureka Street, providing an easy grade highway between the Eureka and Noe Valleys, and connecting with the proposed Market Street extension.

Seventh Avenue Extension Boulevard. As mentioned in Chapter 11, referring to transfer connections at the Laguna Honda Station of the Twin Peaks tunnel, Seventh Avenue should be developed as a supplemental cross-town boulevard down the Peninsula connecting Golden Gate Park with the proposed extension of Market Street and the Corbett Road. It should be widened to 100 ft. throughout, and extended by means of an open cut running beneath the present bend in Dewey Boulevard.

Resubdivision of Hill Property. The blunder of carrying a rectangular system of streets over steep grades has rendered many districts practically inaccessible. For this reason every effort should be made to resubdivide these tracts with streets laid out with some regard to the contours so that transit service may be established thereto. The subdivision of Forest Hill and St. Francis Wood tracts are examples of the possibilities in this respect.

Regrades

Sansome Street. Any plan to change the levels of Sansome Street should also include regrading Pacific and Broadway. Fig. 81 is an isometric view of the regrade which is recommended. In this plan, a direct low-level route to North Beach via Sansome Street may be provided, and the grades leading from the waterfront to the proposed Broadway tunnel will be greatly improved.

Twentieth Street. The 13% grade on Twentieth Street between Hampshire and Potrero Avenue can be reduced to 11.4% by allowing the break in grade to be made at the curb lines instead of the property lines. This departure from the usual practice is justified because of the importance of securing the most direct street railway connections at this point. At Hampshire Street it will be necessary to make changes in the sidewalk levels also to effect proper drainage.

Arkansas Street. Between Twentieth and Twenty-second has a broken grade with a maximum of 15.2%. A cut of eight feet at the "hump" will result in a grade of 12%. A maximum grade of the

line exclusive of this block is 12.5%, and it will serve the summit of Southern Heights, which is now entirely without transportation.

Falcon Avenue, between View Avenue and Romain Street, should be graded to not over 10%; also Twenty-eighth Street between Burnett Avenue and Bellevue Street.

Balboa Street. To secure a practicable grade in Balboa Street it will be necessary to raise the level of Twenty-third Street 12 ft., or to construct a viaduct.

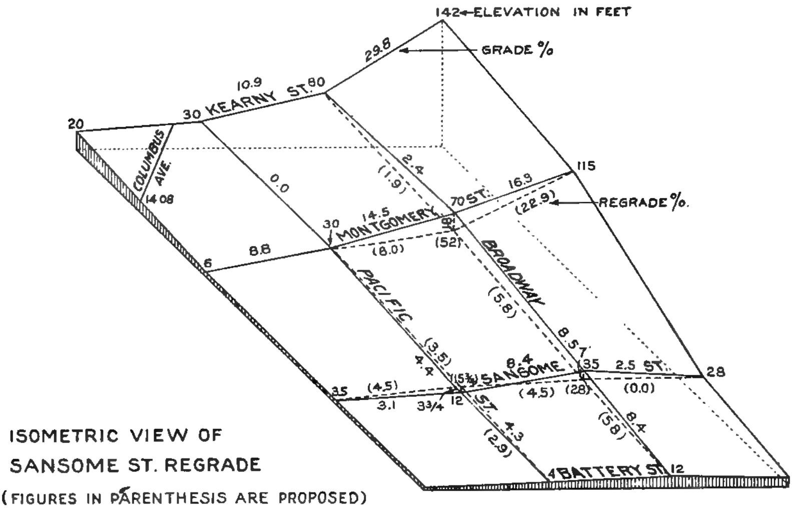


FIGURE 81—ISOMETRIC VIEW OF SANSOME STREET REGRADE.

The fullest utilization of Sansome Street as the first low-grade street to The Embarcadero east of Telegraph Hill is evidently desirable; also the improvement of the entrance thoroughfare to the Broadway tunnel. The full lines represent the present, and the dotted lines the proposed street grades. Both Broadway and Sansome Street should be included in the improvement. As an alternative, Montgomery Street may be bridged over at Broadway to the heavy regrade shown.

Rapid Transit Parking. Where the width of thoroughfares and vehicle traffic permit, a type of construction shown in Plate 18, is recommended, the idea of which is to facilitate rapid car operation without interference with passing vehicles. This plan is in highly successful operation in Boston and other cities. It combines the attractive scheme of the present Dolores Street parking with the most effective transit, and can be applied to advantage on Van Ness Avenue north of Geary Street, Geary Street west of Presidio Avenue, Arguello Boulevard, Masonic Avenue and Sunnyside Avenue. The parking curbs may be used as a step to and from the car platforms.

Park Crossings. have become a vital necessity for the interconnection of the Richmond and Sunset districts, not only for car lines, but also for all classes of vehicles, for precisely the same reasons that there are demands for crosstown car lines in other parts of the City. Three different ways of carrying out this crossing plan are shown in Fig. 82:

1. Double track railway line along the surface, shielded by an earth embankment with trees and thick shrubbery.

2. A depressed roadway for both cars and vehicles, with overhead bridge crossings.

3. Depressed roadway for cars and for vehicles respectively at *different points.*

The first plan is the most suitable for reaching points of heaviest traffic demand, such as the music pavilion. The *maximum convenience* to Park patrons will result from having it entirely on the surface. At the few road crossings existing, a cautionary stop could insure the necessary safety. The contours between Lincoln Way and Fulton Street indicate that the best crossing may be obtained from Ninth Avenue on the south to Tenth Avenue on the north, with a slight detour around the music pavilion. This line should be constructed first. Next, a railway crossing would seem to be necessary in the vicinity of the stadium, as recommended in connection with the extensions of the Geary Street road, in Thirty-seventh Avenue; and later a vehicle crossing in the vicinity of Twentieth Avenue on the south and Twenty-fourth Avenue on the north, as determined by surveys.

The large expense of tunnels under the Park does not appear warranted at this time, as this plan of depressed cut is satisfactory in other cities, a prominent example being Central Park, New York, which is entirely typical of the situation here.

Panhandle Crossing. Masonic Avenue from Waller Street is 100 feet wide, and could be made part of the boulevard system into Sunset, with the central area parked for the car lines as suggested for Van Ness Avenue (Plate 18).

Suggested General Ordinances. To improve the car service, the traffic ordinances could be amended with advantage in the following particulars:

1. Except on slopes over 5% outside the fire limits, all standing vehicles should be placed with wheel tires next the curb.

2. Vehicles, especially slow moving ones, should not be permitted upon car tracks, except where passing others standing along the curb or where streets are otherwise impassable.

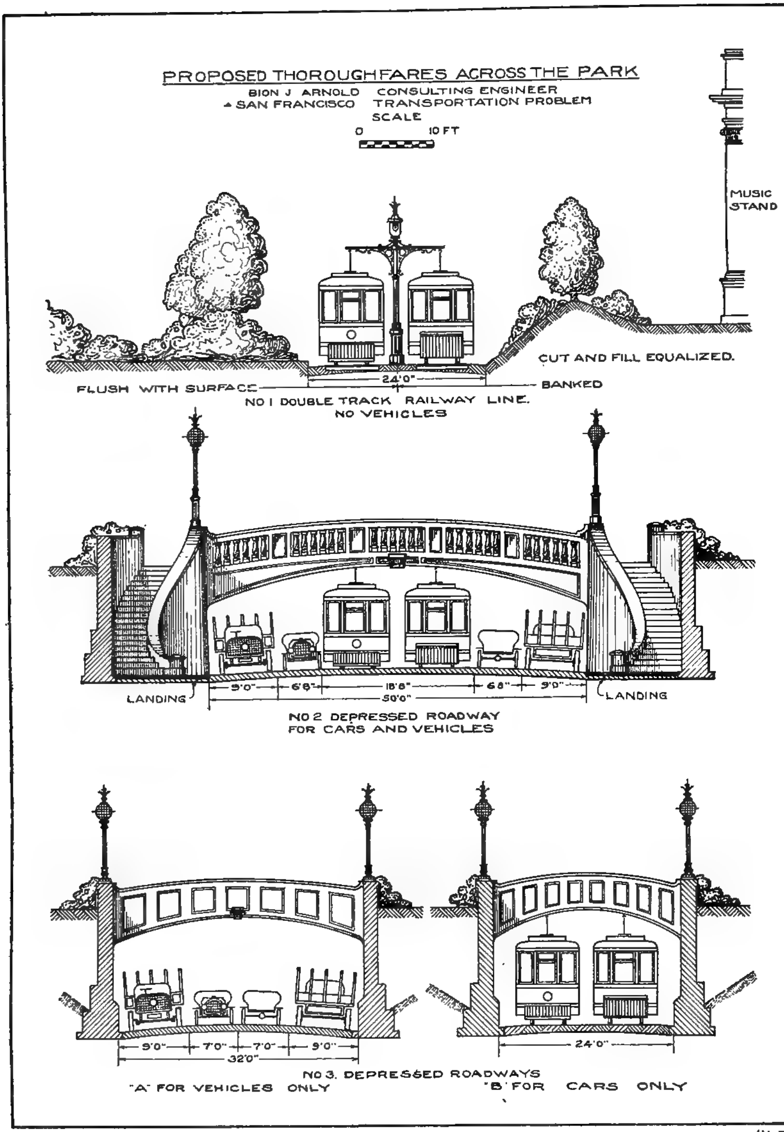


FIGURE 82—PARK CROSSINGS.

Three methods are shown—(a) with roadway removed from sight by shrubbery which also tends to reduce noise; (b) by equalized cut and embankment; (c) with retaining wall instead of graded slopes, bridges and stairways being necessary at the few intersecting drives. The expense of tunnels hardly seems warranted in view of these alternatives. The separation of two such important sections of the city as Richmond and Sunset by three miles of continuous parking requires some form of crossing for both cars and vehicles.

3. Street cars should be exempt from present speed limitations of vehicles.

4. Loading and unloading vehicles backed against the curb should not be permitted during rush hours upon any street in the downtown district with car service.

5. The contracted space between the safety stations and the curb should be kept exceptionally clear of standing vehicles at all times.

6. Vehicles should not stand nearer than one car length to a street intersection, *i. e.,* 50 feet from the property line.

7. Articles relating to width of vehicles, speed regulation at crossings, vehicles passing cars loading and unloading, and vehicles making turns, should be rigidly enforced, and "width of vehicles" should be interpreted to include the load carried.

CHAPTER 13

TRANSPORTATION ON THE HARBOR FRONT

FERRY TERMINAL AND OTHER IMPROVEMENTS

Plans for Permanent Relief of Congestion
Minimum Improvements to be Considered

Traffic congestion at the Ferry has reached a point where the present terminal facilities for street cars are taxed to their utmost, and with the addition of two more car lines—Sutter and Geary Streets—to the main terminal, increased or at least improved facilities in the way of loops and storage tracks will be imperative. In this chapter, the growth and variation in commuter ferry traffic is analyzed with reference to the necessary car service, and detailed recommendations are made for alternative elevated terminals plans calculated to provide permanent relief by increasing the capacity, supplemented by storage tracks for cars awaiting the arrival of a ferryboat. Service for the proposed extensions of the Ferry building is considered; also temporary improvement plans, and provision for the accommodation of pedestrian and vehicle traffic. The plans for the relief of Lower Market Street, Chapter 6, contemplate these terminal improvements although not discussed there in detail.

In recommending improvements in transportation facilities affecting the State property on the Harbor front, it is understood, of course, that the jurisdiction of the City of San Francisco theoretically ends at the west line of The Embarcadero, and that the railway terminals are only permitted to occupy the Ferry frontage as an *accommodation to trans-bay passengers.* However, the interests of the City and State are in my judgment so intimately involved in the matter of transportation that in reality the State is justly bound to co-operate with the City and assist in carrying out any reasonable plans necessary for conserving the interests of the traveling public.

After only a few years of respite from the congestion of the old turn-table, the problem of the Market Street ferry terminal has again become serious, due to the concentration of the entire commuter traffic at a single point of delivery, with every prospect of a continual increase.

This condition will be further aggravated by additional loop traffic from the Geary and Sutter Street lines operating on the outer Market Street tracks.

Unless terminal improvements are speedily undertaken, this in my judgment will create a condition of congestion so much worse than at present as to simply force the withdrawal of part of this additional service to the Ferry. In the plans recommended for handling lower Market Street traffic, Chapter 6, the Ferry terminal was not discussed, but these plans were drawn up with such improvements in view, and are largely dependent upon them for effective results.

Reference has been freely made to a previous report of engineers for the Federated Harbor Improvement Association on the development of San Francisco Harbor. Therein is recommended a plan for an elevated loop structure similar to the alternative plan proposed by me, except that four tracks were to be used with Market Street widened 20 feet and the corners at East Street rounded off. This plan contemplated that surface car traffic should be removed entirely from The Embarcadero, except that running generally in a north and south direction.

CONCLUSIONS AND RECOMMENDATIONS

1. From a careful study of existing conditions and the reasonable requirements of increasing traffic, I fail to find any satisfactory solution of the Ferry terminal problem that can be carried out on the surface within the existing street lines. A comprehensive plan for the equalization of property frontage along The Embarcadero should therefore be put into effect extending from Mission Street to Pacific Street by means of which a Ferry Plaza of adequate dimensions may become available for accommodating an elevated incline structure leading to the second story of the Ferry building; this to be accomplished presumably through the purchase, re-subdivision, improvement and resale of property affected.

2. This elevated terminal structure should be built with incline approaches located *off from Market Street* within this plaza with an elevated two-track loop, fixed car berths, communicating ramps, and reservoir spur tracks at each end of the present building extending back to the rear concourse. These inclines may be concealed within an artistic peristyle structure forming the "Water Gate" of San Francisco.

3. As an alternative plan, it will be necessary to build an *elevated approach in Market Street*, commencing at Spear Street, with a two-track loop communicating with the second floor of the Ferry building. Market Street at present can accommodate only the elevation of the two center tracks. Future four-tracking would neces-

sitate the recession of the southerly building line of Market Street from Spear to East Streets.

4. In any event, the recession of the protruding corner of Sacramento and East Streets is essential to this alternative or any other plan not involving the equalization of frontage, owing to the serious obstruction offered by the present cable loop.

5. In view of the contemplated extension of the present structure loading and unloading should not be concentrated at a single point of entrance to the Ferry building, but should be distributed along the building frontage as much as possible.

6. Separate passageways for entrance and exit should be provided, to avoid interference of passengers moving in opposite directions. A system of ticket booths and guide railings would greatly facilitate rapidity of loading, especially on the upper deck, where the platforms could be enclosed without difficulty.

7. On all terminals, both surface and elevated, sufficient reservoir capacity should be available for permitting cars to lay-over for incoming boats, without obstructing the through trunk lines.

8. A system of fixed berths or stopping places for cars should form a part of any terminal system, with an electric signal system operated by the dispatcher indicating definitely just where incoming cars will berth, in time to enable passengers to reach the berth desired.

9. Foot-passenger ways should be built into the elevated structure in order to permit pedestrians to cross The Embarcadero without encountering the traffic thereon. While a foot-bridge alone would relieve the present surface congestion somewhat, it does not form any *real solution of the problem as a whole,* and its supports would be an additional obstruction in the traffic way.

10. In the alternative plan, while the cars using the outer track could most logically continue to the Ferry on the surface (leaving all the inside track cars for the elevated loop), it is practicable to effect any desirable division of traffic between surface and elevated loops by means of cross-overs in Market Street.

11. In the event no elevated structure is now possible, I consider it absolutely necessary that all three surface terminals should be enlarged to provide reservoir capacity and fixed loading berths, with dispatching by electric signal as later discussed. It is probable that multiple berthing (that is, two or more cars operated as a unit) will produce the best results, especially in view of the establishment of two-car stops in Market Street.

12. The great volume of passenger and vehicle traffic at the throat of the Market Street loops warrants the immediate establish-

FIGURE 83—FERRY LOOP PLAZA DURING EVENING RUSH HOURS.

Note majority of pedestrians on north side of Market Street and close spacing of cars on out-bound tracks; also contraction of throat at Ferry loop due to Sacramento Street corner. Outbound throat completely blocked by cable car. Traffic is frequently much heavier than here indicated but photograph was made to show car placement.

ment of traffic regulation; one careless driver should not be allowed to cause serious delay to such an important artery of travel. With effective policing and more prompt placing and dispatching of cars than at present, car movement could be greatly facilitated. Practically no responsibility should be left to the motormen in the terminal, except to avoid accidents.

13. A track connection in East Street may prove useful (if 4-track operation permits) to complete a loop for the relief of Market Street during rush hours; certain cars to be routed via Market inbound to East, to Mission outbound, and return to Market Street via Fifth, Ninth, Tenth, or Twelfth Streets.

14. The absence of passenger transportation along the Harbor Front, becoming more and more acute as development proceeds, will in my judgment necessitate electric service in addition to steam switching tracks. The present Belt line track in front of the Ferry building should therefore be available for through electric service, with provision for future double-tracking.

15. Electric service tracks to be ultimately carried around The Embarcadero from Fort Mason to the Channel should be located next to the pier wall rather than on the opposite side; this position will be more convenient and incur less obstruction. At the Ferry future Belt line tracks may be so located as to serve their purpose without interfering with the elevated terminal as in the case of the present track when handling large steam road equipments. Any future branches from the Belt line tracks to wharves located close to the Ferry terminal should curve away from the terminal instead of towards it, to avoid the obstruction of the most important entrance throat.

16. Electric parcel and express delivery through the Ferry from the various tributary car lines will very probably materialize in the near future; and in the layout of the two annexes provision might be made to advantage for routing express cars directly into the building for this purpose.

SUPPLEMENTAL DISCUSSION

Through the courtesy of the Southern Pacific, Key Route, and Northwestern Pacific lines, complete traffic counts have been made of commuter travel to and from San Francisco, indicating its general characteristics and rate of growth. The essential results of these voluminous records are presented in the accompanying exhibits, Figs. 84 to 86.

Growth in Commuter Travel. Prior to the fire a steady growth in travel from the Alameda County commuters took place,

averaging 8½%, or 1,750,000 persons per year gain. As a direct result of the fire, this traffic suddenly increased within one year—1907—from 25 to 33 million passengers, a gain of 8,000,000 commuters. Since then the traffic has shown a tendency to return to a more normal level as in 1909, but *is again on the increase.* This temporary decrease in traffic from 1907-1909 is to be construed as a logical resumption of normal conditions rather than an indication of retarded growth. It simply reflects the gradual return to San Francisco of those forced to move across the Bay, and it is probable that the future will record only the *normal increase* due to the general growth of the district.

The suburban travel to Marin County also reflects slightly this recent advance movement, and especially so the down-peninsular traffic, which has been included here as an integral part of the commuter study to indicate the *great possibilities of development of the suburbs lying south of the San Bruno range through electric transit.**

Seasonal Variation. A radical difference exists in seasonal variation in traffic of Alameda County and of Marin County. While the former is nearly constant throughout the year, irrespective of seasons, the Marin County travel increases 75% during the summer months, due largely to pleasure seekers. This is reflected in the Sunday travel from April to August, which is nearly *double* the week-day travel, while the Sunday travel to the Alameda County cities is but a *fraction* of that of the average business day. As a whole, the comparative uniformity of traffic is fortunate in permitting the design of a terminal of considerably more modest proportions than otherwise.

Hourly Variation. The appended traffic load curves show an evening peak nearly twice as great as the morning peak, due to the latter being spread over a greater period of time. Out of a total of about 95,900 commuters using the Ferry terminal daily, 19,000 require service city-bound from 7 to 10 a. m., and 23,800 outbound from 4 to 7 p. m. And finally, 14,000 commuters leave the city *within one hour,* 12,000 of whom are destined to Alameda County alone.

From this analysis, it may be seen that during the morning rush hour nearly five times as many passengers use the Ferry terminal inbound as during the day, and during the evening rush hour, about eight times as many travel outbound. Or considering total *traffic in both directions,* the morning peak is 2.7 times, and the evening, 4.7 times that of midday. As compared with surface transit in the

* This peninsular traffic now represents but little over 4% of the total commuter travel. With adequate electric train service, there is no doubt in my mind that the southerly suburbs of San Francisco could be developed vastly beyond their present state.

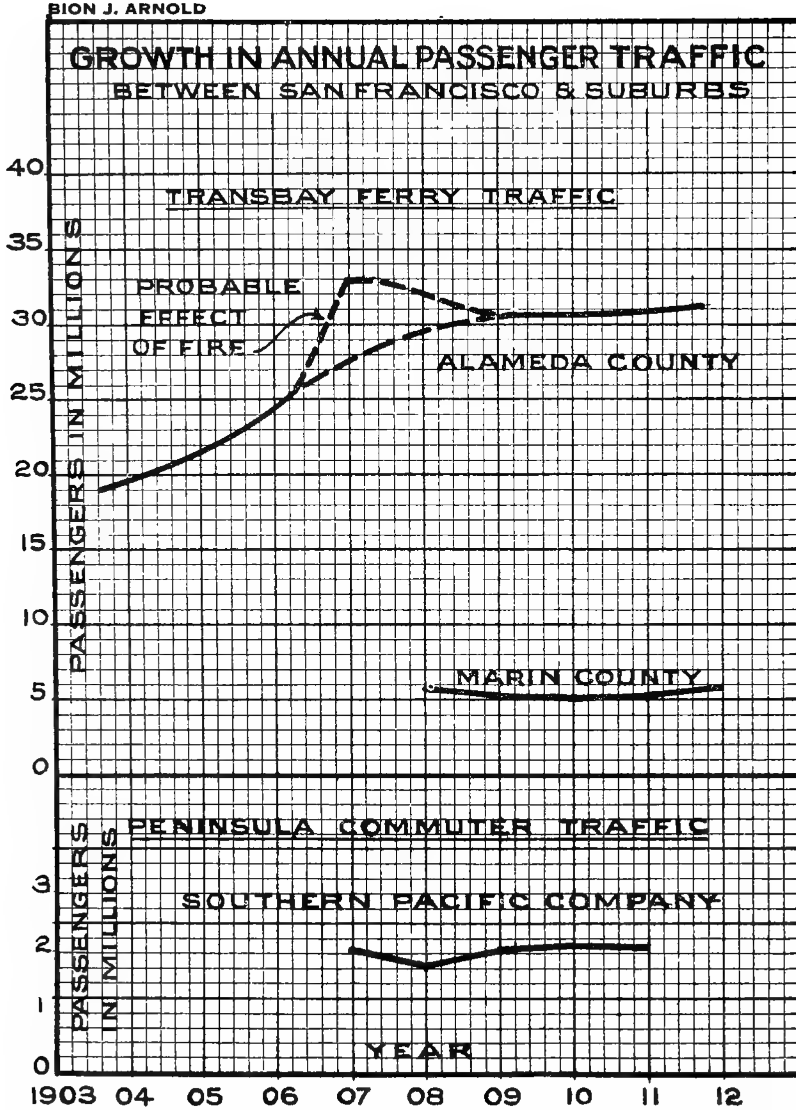


FIGURE 84a—GROWTH IN SAN FRANCISCO COMMUTER TRAVEL.

The annual record of commuter travel by ferry and by rail possesses unusual significance in the study of transit needs of this city. Traffic to Alameda County increased two-thirds since 1904, with a maximum of probably about 33,000,000 passengers per year following the fire. Since then it appears that the exodus of people from San Francisco to Oakland has ceased, and that the cities of Alameda County are now progressing at a more normal rate. Marin County travel is again on the increase, but Peninsular commuter travel appears to remain about constant. Taken as a whole, this record indicates that even with the erratic effects of the great fire, the total commuter travel between San Francisco and its suburbs will probably have doubled within the decade ending this year. At the present time it totals about 100,000 per day average exclusive of long distance travel.

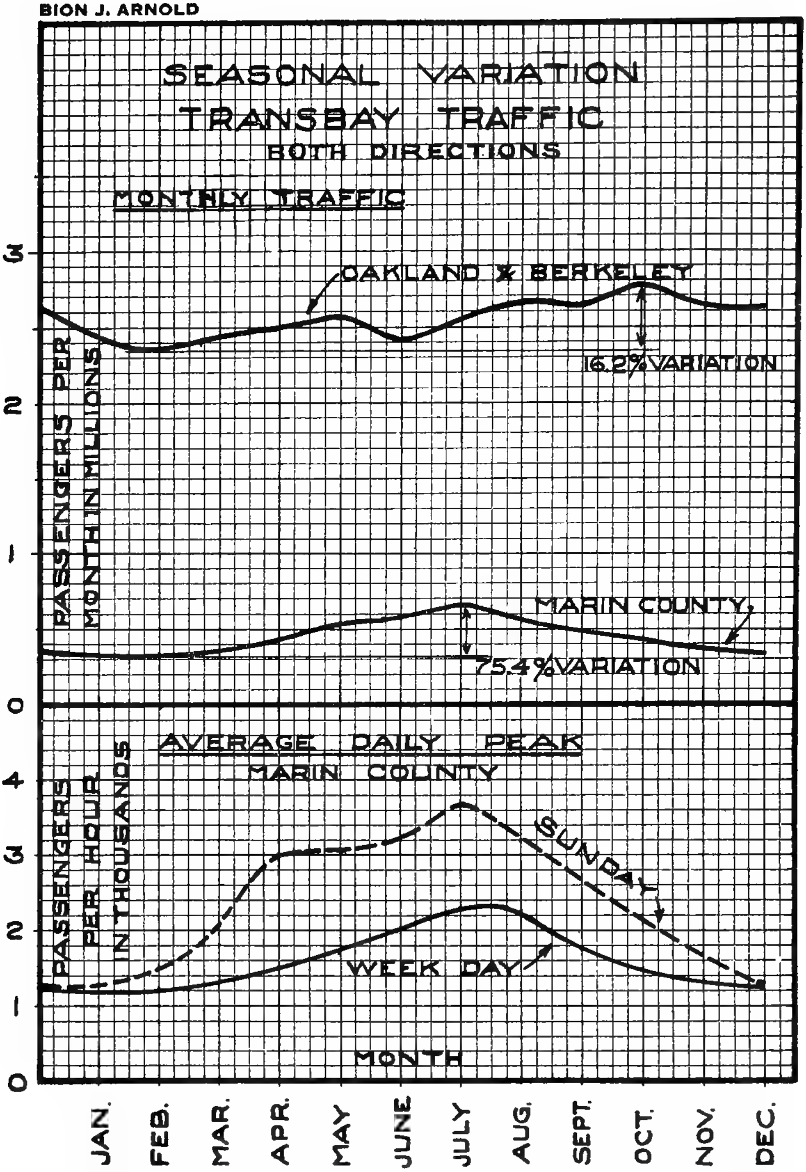


FIGURE 84*b*—TYPICAL SEASONAL VARIATION, TRANSBAY TRAVEL.

A great difference exists in the character of travel to the various transbay communities between seasons. Thus, the maximum yearly variation in Oakland and Berkeley travel is only 16.2%—indicating comparatively permanent residence in those cities; whereas the variation of 75.4% in the travel to Marin County indicates the great influx of summer residents. The lower curves indicate the exaggerated Sunday peak of the Marin County travel as compared with a normal business day, especially during the summer months. An exactly opposite condition exists for Alameda County travel. All these conditions focus in the provision of proper car service at the Ferry terminals.

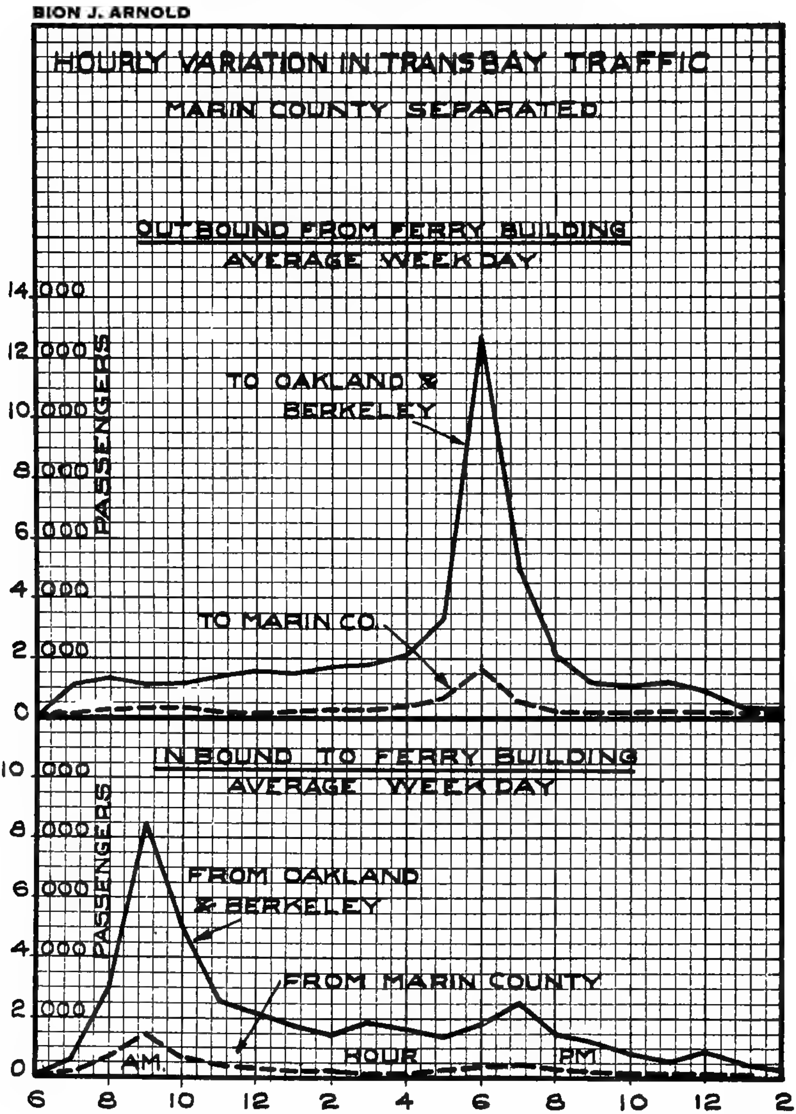


FIGURE 85—HOURLY TRAVEL TO ALAMEDA AND MARIN COUNTIES.

As a result of extensive counts made by the various transportation companies, it has been possible to obtain the hourly variation, as well as to separate Oakland and Berkeley travel from that to Marin County. The diagram thus indicates relative volume—over eight to one during the evening peak load. Inbound and outbound travel is also recorded separately during the period of ferry service. This emphasizes the fact that, whereas the evening railway peak is approximately 2.5 times that of midday travel, for ferry service the morning peak is five times and the evening peak seven times that of midday.

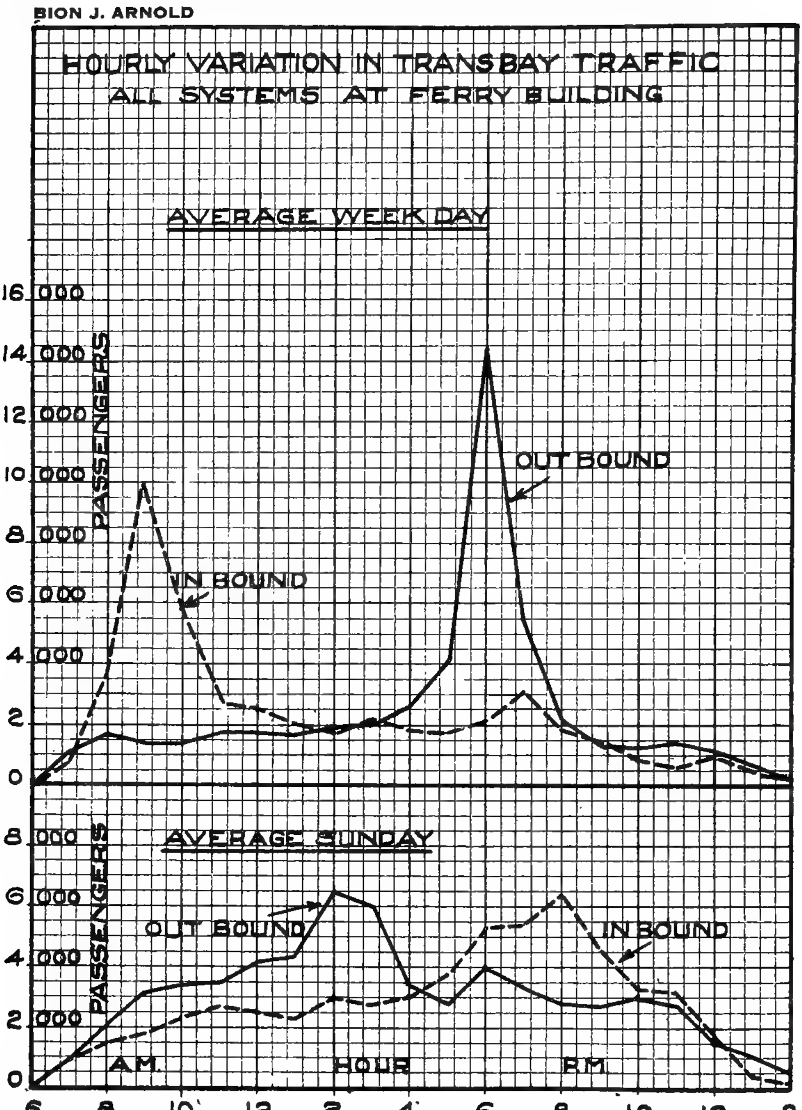


FIGURE 86.—TYPICAL DAILY AND HOURLY VARIATION IN TOTAL ONE-WAY TRANS-BAY TRAVEL.

Here the most notable feature is the very high midday travel on Sundays, as compared with normal week-day travel, due to the in and out-bound peaks being distributed over much longer periods. This means that during midday more car service must be supplied to accommodate Sunday ferry travel than on week-days, although the normal service requirements of the city on Sundays as a whole are considerably lower. This again emphasizes the fact that the Ferry presents a special problem that requires a distinct solution.

city, in which the maximum evening peak is only about twice that of midday, the unusual difficulties arising in passenger service at the meeting of rail and water will be apparent. But this is not all.

Car and Boat Arrivals. That adequate passenger service is practically impossible with the present Ferry terminal, will appear from the graphical record, Fig. 87, representing typical conditions of the morning rush hour. While cars passed around the loops with a fairly uniform frequency† (averaging well under 30 seconds headway) the average cars available during a loading period of four minutes after boat arrivals varied from a maximum of 10 to only 3 1-3 cars per boat. Out of 18 ferry arrivals, *only one was on time,* one was early and the others were from one to eight minutes late. This situation is aggravated by the fact that during the worst part of the rush hour, three boats are scheduled with the same time of arrival, which would have resulted in a *maximum possible car service of only three cars per boat*—that is, a car capacity of 350 against a passenger load three to six times greater. In fact, it appears from this study that reasonably uniform car service could only be expected when the ferries are sufficiently off time in arriving to distribute their passenger loads. Obviously, therefore, one good remedy for this condition is *storage or reservoir track capacity for stand-by cars awaiting the ferry arrivals,* independently of the regular route service. In any event, a great improvement would result from arranging the ferry schedules so that boats would not leave and arrive at the same time. If four or five minutes intervened the maximum car service per boat would result and more nearly fit into the scheme of loop terminals.

Loop Capacity. An unusual opportunity presented itself during the recent Belt Railroad construction to observe the adequacy of the present loop layout for ferry traffic. During this time the inner loop only was in operation for accommodating all Market Street lines. By actual count 134 cars per hour passed around this one loop, but the congestion resulted in the stalling of a complete line of cars as far back as Second Street—over 3,000 ft.

The average duration of stop of these cars was 1½ minutes, which probably represents the fastest speed possible to obtain through the terminal. Obviously, therefore, the maximum capacity of the inner loop represents 80 cars per hour if it is desired to avoid congestion along lower Market Street and to enable commuters to reach their boats promptly. Although the outer loop accommodates three car berths against two on the inner loop, its full

†However, even a slight variation in headway affects the service seriously thus: a car 30 seconds late on the loop reduces the ferryboat service by 12½%.

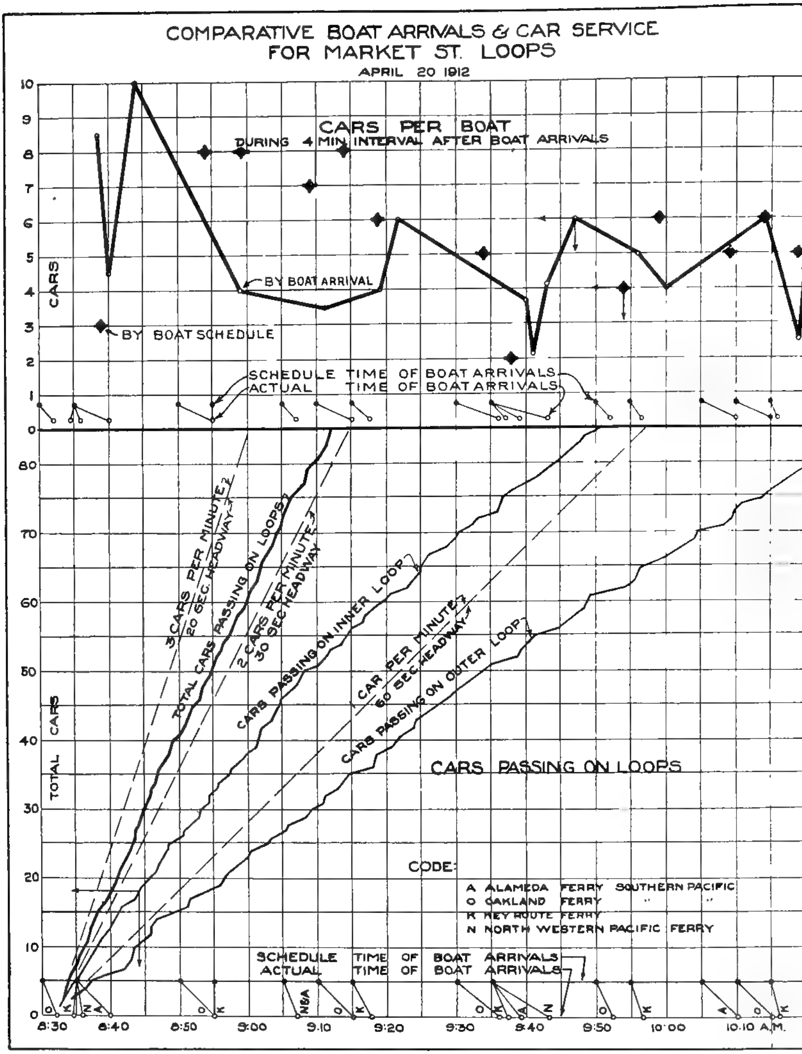


FIGURE 87—COMPARATIVE BOAT ARRIVALS AND CAR SERVICE ON THE MARKET STREET LOOP.

The impossibility of serving adequately a bunched ferry traffic by a uniform flow of cars passing around the Ferry loops is here graphically illustrated from actual observations during a typical morning rush hour. The great irregularity of service resulting is indicated by the upper curve of cars per boat arrival. At the bottom, the scheduled and actual boat arrivals (black dots and circles) show that the boats were mostly behind time, and fortunately so, otherwise the 8:35 a. m. boat service would have been reduced to only three cars per boat. Had all boats arrived on time, the available service would be represented by the large dots on the upper diagram. The great necessity of a more distributed boat schedule is evident from the fact that the present loop capacity is unable to serve more than one boat. A few minutes' interval between boats, however, would result in from two to four times the present service.

capacity is unavailable as the access to the inner loop would be practically cut off. For this reason the total capacity of the two loops, assuming unobstructed entrance to the terminal, probably does not exceed 160 cars per hour. This means that *only half of the Sutter and Geary Street cars can be run to the Ferry,* even with four tracks, and that some of the Market Street lines must be diverted to Mission Street on their outbound trip. In other words, the loops have become the most deficient element of the terminal.

Recent Changes. The re-arrangement of the present stub terminals does not offer in my judgment the slightest improvement in terminal facilities—and in some respects the reverse:

1. No additional storage track has been provided.
2. Terminals are more distant from the Ferry building.
3. The Embarcadero is more restricted at its most important throat.
4. No passenger concourses lead to the terminals.
5. Interference between persons and vehicles is not relieved.

Terminal loops should be located as close to the Ferry as practicable, and cab-stand space reserved outside. Excepting for the necessary driveways, cabs should be excluded entirely from the main passenger concourse. Fortunately, in the present situation considerable space is available for additional storage tracks required on both north and south side terminals. The remainder may be devoted to cab-stands. The reservation of cab-stand space should never take precedence over passenger car terminals, between which two methods of conveyance there is no comparison as regards capacity and resulting importance.

Improvement Plans

Methods for alleviating the present conditions and perfecting the operation of the terminal structure may be discussed as follows:

1. Permanent terminal structure sufficient for the needs of the future, as well as the present.

2. Alternative terminal plan meeting the above conditions as far as possible, with minimum disturbance to existing street lines.

3. Plans for immediate execution, serving as a temporary relief with minimum expenditure.

East Street Frontage. The unfortunate irregularity in the alignment of building frontage north of Market Street is apparent from a study of Plate 19; and the most effective method of preserving the normal width of the thoroughfare is to *equalize the property frontages* by some method of "cut and fill." After much study, I am convinced that the most practicable method sufficing for all time

will be to establish a rotunda centering about the present Ferry building with a curved frontage of about a 1350-foot radius. This rotunda will provide room for the erection of a proper terminal structure as later outlined, leaving The Embarcadero practically unobstructed for vehicles.

This plan of equalization contemplates the co-operation of the City and State authorities in the purchase, improvement, and re-sale of all frontage affected. As a result, *no property is lost or gained,* the same building area being available as before with a probable increase in rental value due to uniform frontage.‡ The closing of Steuart Street from Mission to Market Streets may be regarded adversely by some, but as this is a blind street and therefore of little value as a thoroughfare, the creation of a new block practically square is entirely justifiable. The necessity for this change will now be apparent.

Recommended Terminal Structure. In this plan, which may be regarded as suited for future requirements for some time to come, the essential features are:

1. Market Street traffic delivered direct to the upper deck of the Ferry building.
2. Market Street kept clear of elevated structures, thus avoiding obstruction to both vehicle traffic and the street vista.
3. Reservoir tracks communicating directly with the rear concourse of the Ferry building, for the accommodation of lay-over cars.
4. Fixed position of car berths when loading and unloading, with an electric dispatching system announcing the exact berthing of cars prior to their arrival.
5. Segregation of inbound and outbound passengers to avoid interference.
6. A system of inclines or ramps giving convenient communication between the various levels without stairways.
7. Adequate surface terminal loops for north and south side lines with ample storage tracks for lay-overs.
8. Automobile, bus and cab stands unimpeded by foot passengers.
9. Elevated sidewalks to enable pedestrians to reach the westerly side of East Street.
10. Removal of Sacramento Street cable line from interference with Market Street traffic.
11. Unobstructed vehicle way along The Embarcadero.

‡ It may occur that through the improvement of this frontage with office or commercial buildings, so much increased value may be realized as to warrant a still further recession of the proposed curved building line of the plaza. For an increased depth of the plaza directly in front of the Ferry building, would be advantageous in easing the curves of the elevated structure and providing wider roadways for vehicles crossing the plaza.

The acompanying designs must of course be considered general in their nature. In the ground floor plan, Plate 19, it will be seen that the major obstruction of the street is due to the inclines located *in line with East Street traffic, and not across it*. The two surface terminals at the side preferably have an outer loop for the more important routes and reservoir stub tracks for lay-over cars waiting for boats.

The disposition of the Belt line track next to the Ferry building is now such that it should be utilized for electric service around The Embarcadero, particularly in the direction of Fort Mason during the Panama-Pacific Exposition. With a difference in elevation of only 16 feet between the first and second floors of the Ferry building, there must be a departure from the usual standard of clearance between freight cars and overhead structures; for the standard 22-foot clearance would necessitate an extra climb of probably 10 feet. It would be manifestly unjust to discommode the public in this manner simply to maintain a steam road standard. These designs have, therefore, adhered to a platform elevation of 20½ feet with a minimum street clearance beneath girders of about 17 feet. These elevations permit entrance to the Ferry building by easy grade ramps, and also the segregation of passenger movement, without encroaching too seriously upon the ground floor headroom.

Referring to the upper level plan, Plate 19, independent loading platforms are provided to the right and to the left of the main building, with entrances through the front and ends into the central concourse on the second floor. Reservoir tracks extend back to the rear concourse in the space between the main building and the two annexes. There are thus three large entrances at each end of the main building.

The separation of the loading platform into two parts has resulted from the extreme length of the Ferry building, now 650 feet, and eventually nearly twice this length, which makes it impossible to serve such a great frontage from one point. With two stations those desiring to use the south slips may alight at the south platform, and similarly for the north slips. However, if this elevated structure is completed long before the annexes, it would be entirely feasible to extend each platform toward the central tower, providing additional openings through the building front as in the alternative plan, Plate 19. Later, the platforms could be extended north and south as here shown sufficiently to serve each annex.

In this plan, wide platforms are provided between inner and outer tracks to serve as a distributing concourse. From these, short stairways descend to mezzanine galleries communicating with both upper and lower levels by easy grade inclined ramps. (Incidentally,

this space between tracks provides for an extra storage track and cross-over between stations for use in case any of the berths become blocked.) This arrangement is detailed in the elevation, Plate 19, the object of which is to avoid the necessity of crossing loop tracks as at present. Although it might be permissible to dispense with these mezzanine passageways if prompt dispatching and policing is practised, some such method will have to be eventually adopted if the full capacity of the terminal is to be realized.

Lastly, the artistic features of this structure may be readily conserved by constructing the inclines concealed as an integral part of a massive peristyle and archway spanning Market Street. This could be made a most attractive feature of the entrance to San Francisco, in the form of a "Water Gate."

Alternative Terminal Structure. In case it is found impossible to carry out the equalization of the East Street frontage, practically the only alternative is that delineated in Plate 19. Here a 6% incline is built in Market Street reaching a height of about 16 feet over Steuart Street, thence extending on a level by elevated loop to the front of the Ferry building, a continuous station platform floor communicating with the main building concourse by central and side entrances on either side of the present waiting room. Owing to the location of the present Belt line track next to the Ferry building, it becomes *impossible to use mezzanine galleries* as in the previous plan recommended, designed to avoid the crossing of loop tracks as on the present surface loops; for in order to obtain sufficient platform area, the elevated loops had to be moved so far out from the building that these galleries would necessarily interfere with steam cars passing beneath.

Fixed car berths would be used in this plan in connection with an electric dispatching system with visible berth indicators. Undoubtedly, the maximum capacity would be realized by group operation—*i. e.*, loading and unloading on groups of two or more cars as a train. Otherwise the operation of more than three berths becomes complicated and liable to delays as now exemplified in the surface loops.

Cross-overs at Spear Street permit any desired distribution of cars on the upper level from inner and outer tracks on Market Street. However, this plan contemplates retaining the present surface loops at the Ferry, *which could be most conveniently used by cars using the outer tracks on Market Street,* as no cross-overs would then be necessary.

One essential to all alternative plans is the recession of the Sacramento Street corner to enable the Sacramento Street cable cars to round the curve next to the building line without interfering

either with electric cars or vehicle traffic, and as a matter of fact both corners should be cut off on some symmetrical plan to accommodate this elevated structure properly. Elevated foot bridges may be conveniently arranged as a part of the elevated structure to deliver passengers directly to the sidewalk from the ferry building.

The commencement of the incline at Spear Street would allow cars routed down California Street to intersect Market Street and reach the Ferry without serious interference, thus making possible *a rapid ferry service direct from Kearny Street* if found desirable.

While this plan permits of no expansion into a four-track plan within the present width of Market Street, the first structure if located centrally may be duplicated to accommodate four tracks if the southerly line of Market Street is receded 20 feet from Spear Street to The Embarcadero. But as this will be hardly probable in the future both on account of the expense of removing costly buildings and of rendering the thoroughfare unsymmetrical, this alternative plan may only be regarded as involving a two-track elevated and surface loop system each with reservoir capacity about twice that of the line. This plan is therefore an improvement in so far as car traffic may be diverted to the upper level. However, as it affords a private right-of-way through the most congested section of lower Market Street and an effective terminal system as well, its capacity would obviously be much greater than if the same additional loop capacity were provided on the street surface.

Temporary Improvement Plans

With the equalization of the East Street frontage, it would be readily possible to extend and perfect the present surface loops for the provision of fixed stopping berths and ample reservoir track capacity. The north and south side loops, which presumably will always remain on the surface, could also be enlarged. But even if the equalization plan is at present impracticable, the recession of the Sacramento Street corner should by all means be carried out. I again emphasize this as imperative.

Minimum Improvements. For the present terminal system, the minimum improvement work which in my judgment can be considered in preparation for 1915 is as follows:

1. South side stub terminal: Increase in track capacity for at least eight cars, with an outer loop arranged for the use of the Mission Street cars, lay-overs to be accommodated upon the stub tracks.
2. North side stub terminal: Increase in track capacity for at least eight cars and an outer loop.

3. A connection along East Street for the routing of cars inbound on Market Street to the outbound tracks on Mission Street to complete the downtown loop mentioned elsewhere in this report if 4-track operation permits.
4. The rearrangement of the present loops to provide for at least three cars on the outer and two cars on the inner loop, practically *loading on the tangent,* with a third inner loop or straight spur installed for storage purposes; an additional spur to extend north as a connection to the north side stub terminal and a connection south with the Mission tracks.
5. Fixed stopping berths with multiple car stops, guide railings for the segregation of passengers and a system of indicative dispatching as above mentioned.
6. An elevated passenger walkway extending from the upper level of the Ferry building to the westerly sidewalks on East Street, with descending stairways landing in the center of the loop and at points convenient to the north and south side stub terminals.

The greatest difficulty at the terminal at present is the uncertainty of berthing, which is left entirely to the discretion of the motorman without any visible sign indicating the limits of such berths. Such operation is entirely too crude for a modern terminal and a system of fixed berths is imperative. By this plan, persons boarding cars will have from 30 to 60 seconds to reach their proper berth as indicated by the signal board and much delay will thus be avoided by passengers being *ready for boarding.*

An excellent example of the effectiveness of such a method of dispatching is offered by the handling of cars at the Park Street station of the Boston Subway. Here, cars are handled in groups of five as a train, although operated individually, with the result that at times of maximum traffic as high as 240 cars per hour are operated on a single track; this, however, with a free run between stations on a private right of way. With multiple unit operation in groups of two or three cars it is believed that conditions at the Ferry would be much improved.

PART V

ANALYSIS OF RAILWAY OPERATION AND RECORDS

CHAPTER 14

ANALYSIS OF FINANCIAL AND OPERATING RECORDS

Primary Data and Findings of Fact
Derived Results and Ratios

To determine whether or not the transit business in San Francisco is inherently sound and profitable; whether the property is operated and maintained efficiently, and whether the methods of financing and accounting are such as to secure reasonable service in the future, it has been necessary to analyze the financial and operating records of the entire transit system for 10 years back, especially to eliminate the effect of the disturbances of 1906-07. This chapter contains a brief summary of this detailed study, which unfortunately was made difficult, and in some respects limited, by the destruction of records during the fire. However, it was not deemed a function of this report to completely audit and examine the internal details of financing, stability of sinking fund, and integrity of profit and loss account; but rather to examine the financial machinery with reference to its sufficiency for perpetuating a railway property able to render adequate service and provide the necessary stability of the true investment.*

GENERAL SUMMARY

1. The transportation business in San Francisco as a whole is unusually profitable, due to very short haul and high riding habit. It should net over 6% on $40,000,000, or 10% upon a more conservative investment figure of $25,000,000, even with an operating ratio as high as 70%, *i. e.,* including all proper charges against income as discussed and recommended herein.

2. The net income in 1911 totaled 6.8% on the $40,000,000 bonded debt, while the average interest rate actually paid on $47,454,000 first lien securities was 4.84%, including dividends on $5,000,000 first preferred stock (none have been paid on preferred and common since 1906). The property has averaged a net income of 3% on a total capitalization of $80,000,000 since the consolidation. But under present conditions, this excess capitalization cannot hope to earn a return as contemplated in the reorganization plan,

*Such a detailed audit clearly falls within the jurisdiction of the State Railroad Commission under the creative law establishing the Commission in a direct supervisory capacity over the financing of all public utility corporations operating in California. Decision No. 439, rendered Feb. 4, 1913, touches upon these matters in a preliminary way, but sufficient to confirm the accuracy of the general conclusions presented herein which have been reached independently during the progress of this investigation.

except to result in such poor service as to defeat the purpose of such a move.

3. The present corporate organization, as a means of unifying some twenty scattered competitive properties, is justifiable from an economic standpoint in the production of maximum service at minimum expense. But with no preparation for grave contingencies such as an ever-possible strike, the developments of late years have resulted in depreciation of securities and the forced issuance of high-rate loans or the equivalent superimposing of preference securities. This capital shortage resulting from depreciation accruing prior to the fire is distinctly due to the Company's failure to provide, out of income of profitable years, adequate reserves for this purpose in the form of cash or negotiable assets.

Losses in earnings from the fire and strike aggregated nearly $5,000,000 for the period covered by these two disasters, and resulted in an annual setback of at least $1,000,000. Of this total loss, at least two-thirds is due to the strike alone, which brought about the necessity for high-rate securities and floating debts. On account of these contingencies, the Company has written off $3,281,809 out of profit and loss. The property loss, with the exception of track and overhead in certain parts of the city, was practically covered by insurance.

4. Since the consolidation of 1902, the Company has expended about $10,000,000 for "betterments" and some additions to property (excluding bond discount), but approximately half of this has been capitalized. *Future betterments should be financed out of income without increased capitalization until the property has caught up with itself in the matter of deferred renewals due to depreciation, obsolescence, or inadequacy.* Extensions and additions may justly be capitalized. But the only way of increasing the value and stability of the business is to *build up the property out of earnings, thus gradually reducing the intangible elements.*

5. An average depreciation reserve of 3% has been maintained since the consolidation. None was charged off between 1906 and 1909. The rate of 6% of the gross earnings per annum now established (1910, 1911) may be fair for the property under normal conditions, if enough is spent upon maintenance, and should be continued on a cumulative basis. But a higher reserve will be necessary for some years—probably 8%—until the property is reclaimed from its present run down condition. A depreciation and renewals reserve should be always available as cash or quick assets, and charged against income as a more or less fixed element of the operating account.

6. The annual appropriation for maintenance (repairs and upkeep) has remained practically constant at about 12% for ten years, except for 1906-7. Due to increased efficiency resulting from consolidation of departments, the equipment is in better condition now than at any time since the fire, but the poor condition of the track and roadway requires additional maintenance and renewal. A total appropriation of 12% represents probably the minimum for this system for the next few years, in addition to 6% minimum depreciation reserve. This total of 18% for these two items I believe is ample, but the division, if any is made, should be different, *i. e.*, maintenance about 10% and renewals about 8%.

7. The sinking fund on U. R. R. 4's was established on about the usual basis for a long-term franchise, but is correspondingly inadequate for short terms unless franchise extensions could practically be guaranteed. Under existing conditions, a sinking fund retiring nearly 50% of the debt is needed—sufficient at least to retire the fixed property in the streets that would either revert to the City at maturity or be sold on a salvage basis. The U. R. R. 4's sinking fund will retire only about one-third of the entire issue at maturity, assuming its investment entirely in these same bonds at *market value*.† The retirement by this method is exceedingly advantageous, as the present price secures about a 6% interest rate to the credit of the fund. The sinking fund on the Market Street Ry. 5's (1924) can only retire about one-sixth of the issue at maturity, providing there be no further increase in outstanding bonds of this series, $10,000,000 of which are yet unissued.

8. Net income over and above interest has decreased by one-half since 1902, due to an increase in both operating expenses and fixed charges, principally the latter; likewise, the balance available over sinking fund due to increased annuities. The so-called "surplus" available for dividends decreased from 15.5% to 4.5% and was about sufficient in 1911 to carry the first preferred stock, assuming depreciation charged against earnings in the usual manner.*

9. The net operating ratio, now 54.5% (or 65.7% including taxes and depreciation), is about the same as ten years ago, al-

† However, the deed of trust does not specifically state that investments be made at market price when below par. And it is understood provisions in other of the underlying sinking funds are also loosely drawn.

*Theoretically, it is not proper to consider this sinking fund annuity as surplus available for dividends until the funded debt retirable by these annuities is actually cancelled and the liability removed. Although every dollar of annuity *eventually* releases a credit equity of $1 in the form of capital asset, the net result of the operation of the sinking fund is simply to gradually transfer an equivalent equity in the property from the bondholders to the stockholders. And until this transfer is consummated, dividends cannot properly be declared on surplus created from sinking fund except as scrip or stock dividends that may be realized at maturity. Until the original liabilities are retired, the equivalent equity does not appear and never represents cash assets. The borrowing of money to pay such equivalent dividends is questionable policy under present conditions.

though it had decreased to 45.7% in 1906. It now again shows a tendency towards decrease. With the increased maintenance and car service necessary, an operating ratio of 70% may very probably have to be considered as a future standard, if any substantial share in the earnings is to come to the city through a re-settlement. Thus, with 18% maintenance and depreciation and the balance (difference between 65.7% and 70%, or 4.3%) available for the City's share and a possible bonus to employees, the business for 1911 would have paid 6.3% return to the Company on its outstanding bonded debt of $40,000,000.

10. The cost of power in San Francisco is high, partly on account of the power consumed on steep grades, but also by reason of a high-priced contract for power forced upon the Company after the fire and strike. Although the bulk of the power is now supplied by an affiliated company at a fair price, the cost of power as now charged against operation is higher by about 3% of the gross earnings than if the Company owned its own power plant and paid fixed charges thereon. The operating ratio is therefore high as compared with former years. However, the Company is now purchasing its supply at a rate probably as reasonable as it could produce it for in its own power house, and is using this power efficiently under the prevailing conditions.

11. Taxes in per cent of gross have reduced materially since 1902 and also since 1910 by reason of the new corporation tax law, which went into effect at that time. While the total proportion of taxes is considerably less than Eastern companies are called upon to bear, the City itself receives less than 1% directly. It thus appears that a more substantial City's share in the transportation business of San Francisco, whether taken in the form of revenue, increased service or otherwise, is not unreasonable.

12. The relative platform expense, in per cent of gross earnings is comparatively low at the present time, 17.85%, and is decreasing, due to increased speed and density of travel. This has been accomplished with a cost per car-hour considerably higher than in any of the Eastern cities, and only exceeded in one instance on the Coast. While this indicates effective construction of time schedules for trainmen, it is also true that the service at the present time is probably at a minimum, and with the increase in car-mileage now required, the platform expense will have to be increased unless a corresponding saving from re-routing can be effected. The average wage has been increasing yearly since 1908, and is now the same as before the fire, 26.9 cents per hour.

13. The time schedule for trainmen has been worked out for an average operating day of 10 hours. In spite of the short-time

demands of the rush hours, only 5.6% of the men are paid for less than nine hours, and 22.4% work over 11 hours. There is no minimum wage. It is apparent that any material reduction of the hours of labor, fixing of maximum time limit, or of a full day's pay for short time service would necessarily result in a large increase in platform expense. Thus the present Charter wage scale if adopted by or if forced upon the Company would probably increase this expense by one-half, which is practically out of the question with a fixed 5-cent fare.

14. The accident account expense from injuries and damages is extremely low—under 3½%, as compared with 5 to 8% in Eastern cities. This undoubtedly reflects to a certain degree the excellent climatic conditions from a railway operating standpoint as well as good maintenance and operation.

15. A condition greatly favoring the Company is the comparatively small seasonal variation in travel as compared with Eastern cities. This, in addition to the uniform climate, relieves the Company of the capital burden of carrying additional summer equipment for use during only a part of the year. Obviously, this condition should make it *possible for the Company to render correspondingly better service.*

16. The average revenue fare or unit of income has remained practically constant at 4.97 cents. Some dilution arises from school tickets, passes, and free transportation to certain municipal employees. The average income per total passenger is reduced by transfers to 3.47 cents, but this fact has no material bearing upon the earning capacity of a system holding a practical monopoly, for the reason that every fare is retained in full wherever it may originate in the system. Nearly half of the revenue passengers avail themselves of the transfer privileges which are very liberal, in fact could be very properly curtailed in some respects without discommoding honest patrons in order to prevent "loop riding."

SUPPLEMENTAL DISCUSSION OF RECORDS

Financial, Operating, Traffic and Ratios

In the following analysis only such matters are discussed in detail as will assist in the interpretation of exhibits appended where not covered sufficiently in the general summary preceding. Authority for these statistics is cited in each instance, and it should be stated here that such exhibits as forbid analysis under the limitations of this investigation referred to at the beginning of this chapter are necessarily accepted at their face value.

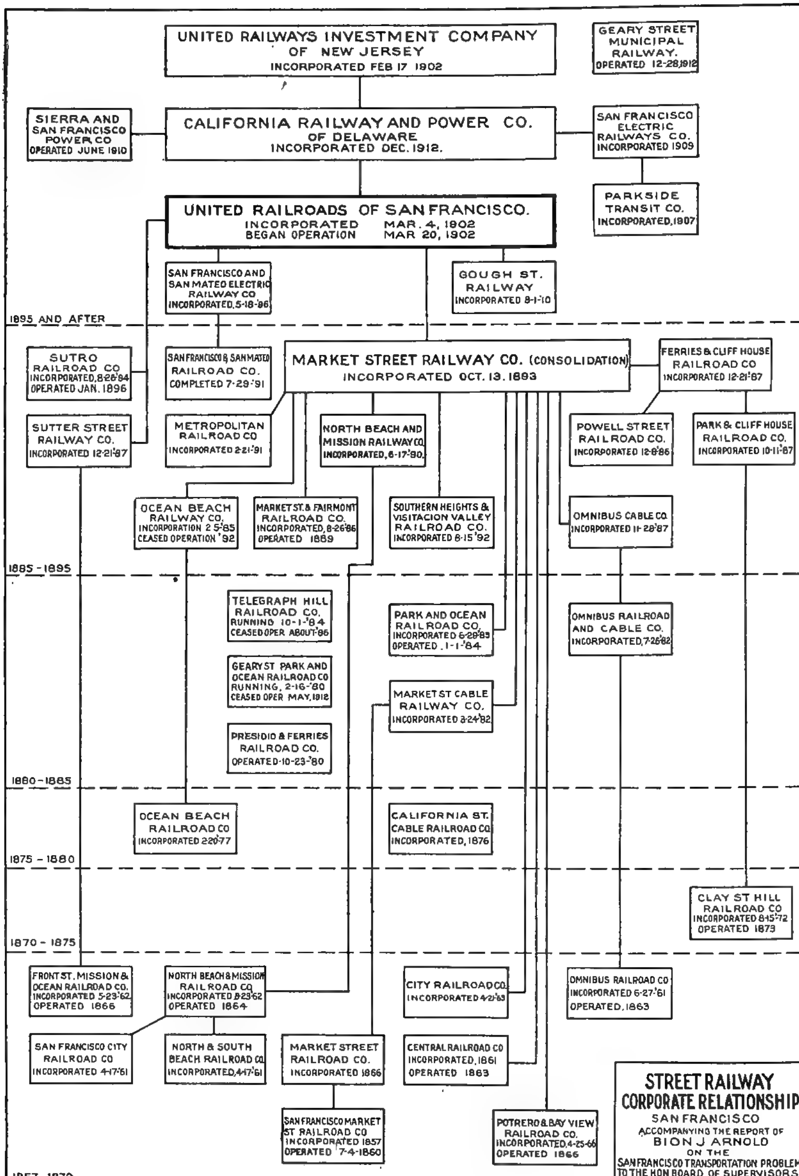


FIGURE 88—THE "FAMILY TREE."

This chart indicates, by various periods, the organization and development of the street railways in San Francisco and subsequent consolidations. The first major consolidation, in 1893, resulted in the Market Street Railway Company. This corporation, together with the San Mateo, Sutter Street and Sutro lines, was absorbed by the United Railroads of San Francisco in 1902. An intermediary holding company was recently organized—California Railway & Power Company of Delaware.

Incorporation and Purchase. The United Railroads of San Francisco was incorporated under the laws of California March 4, 1902, with the following capitalization: $20,000,000 common stock; $20,000,000 4% cumulative preferred stock; $35,275,000 general first mortgage 4% bonds. Of these bonds $20,000,000 were used as part payment for the properties and franchises of the constituent companies, $9,866,000 were reserved to retire the underlying debts unprovided with sinking funds, and $5,409,000 were reserved for "future additions, betterments, and acquisitions."

Under the plan of purchase the United Railways Investment Company sold to the United Railroads certain shares of stock and the railroad lines, properties and franchises of the Market Street Railway Company, San Francisco and San Mateo Electric Railway Company, Sutter Street Railway Company, and the Sutro Railroad Company, with a cash bonus of $1,600,000 to be used for additions and improvements, and received in payment therefor the following United Railroads securities: $20,000,000 general first mortgage 4% bonds; $20,000,000 4% cumulative preferred stock; $20,000,000 common stock. The properties of these constituent companies were already mortgaged for $13,091,000, and $1,500,000 additional Market Street Railway Company bonds were subsequently issued, making a total underlying debt of $14,591,000 which the United Railroads assumed and provided for in the plan of capitalization.

Capital Liabilities. At the present time (June 30, 1912) the total securities of the United Railroads (Table 34) are $85,402,600, of which about half—$47,454,000—are bearing interest at an *average rate* of 4.84%, resulting in a fixed annual charge against income of $2,297,150. These interest-bearing securities include $5,000,000 of 7% first preferred cumulative stock, on which dividends have been paid since July 15, 1908.

Stock. The original issue of $20,000,000 common stock was reduced in 1908 by the voluntary surrender by the stockholders of $1,200,000 face value of these securities to offset fire losses and extraordinary expenditures which had been temporarily capitalized. Later, the common stock was further reduced by $851,400, which stock is now held in the treasury. The total outstanding common stock is therefore $17,948,600, and is all owned or controlled by the California Railway & Power Company, except directors' shares.

The original issue of $20,000,000 cumulative 4% preferred stock is all outstanding, and has been acquired by the California Railway and Power Company through the United Railways Investment Company.

In 1907 the United Railroads floated an issue of $5,000,000 first preferred 7% cumulative stock, the necessity for which was caused

by an extraordinary increase in current liabilities to nearly $6,000,000, brought about through the effects of the fire and strike upon the earnings of the Company, and also by the expenses incident to the change in motive power from cable to electricity. It was, therefore, incumbent upon the Company to immediately increase its working capital so as to absorb these current liabilities. This was accomplished by the issue of first preferred, in the nature of a debenture or first lien upon the net surplus of the Company. The United Railways Investment Company owned the entire issue, but it is understood that the California Railway & Power Company has acquired title to this stock through an agreement with the United Railways Investment Company, and that the stock will be exchanged share for share for California Railway & Power Company preferred.

Summarizing, all outstanding stock of the United Railroads except directors' shares, is owned or controlled by the holding company—California Railway & Power Company.

Bonds. During the period from 1906 to 1909, inclusive, the 4% bonds held in reserve to the amount of $5,409,000, for "future additions, betterments and acquisitions" were sold, excepting $75,000, at prices approximating 73—*i. e.*, with an average *discount* of 27%. An equivalent interest rate of 5.46% is therefore being paid, which would be increased to 6.15% on the present market price—65—indicating the impracticability of floating such securities at a reasonable interest rate. The above discounts have been capitalized as a charge to betterments.

During 1906 and 1907 an additional issue of $1,500,000 Market Street Railway 5's was sold, on which an average *premium* of 6.72% was realized, which has been deducted from betterments in the general balance sheet. This issue was provided for in the original plan of capitalization.

The refunding reserve of $9,866,000 has not been called upon, due to the low market price of the 4's prevailing at the time the underlying issues matured. There seems to be no future possibility of being able to utilize this reserve of 4's for refunding purposes because of the heavy discounts incurred. But it is believed that by refinancing the 4's to a 5% basis, the market price would be so greatly improved as to make refunding still practicable through this reserve.

The only deferred sinking fund requirement is that of the Market Street Railway, which runs from September 1, 1918, to the date of maturity, September 1, 1924, with an annual contribution during this period of $160,000, which at 5% would amount to only $1,088,306. There is an authorized issue of $17,500,000 of these

underlying bonds, of which $7,341,000 are outstanding at the present time, so that at least $6,000,000 or 82% *must be refinanced* or retired from earnings at maturity providing the outstanding securities are not increased.

Considering all bonded debts, a maximum of about $13,000,000 will be retired by sinking funds at the various maturities as near as can be now estimated, leaving $27,000,000 unfunded.

In addition to the bonded indebtedness, there was on June 30, 1912, a floating debt of $2,529,000 in income and equipment notes, mostly unsecured.

Income Account

The United Railroads began operation as a system on March 20, 1902, so that a comparison of the two previous years with 1903 will indicate comparative operation by underlying companies forming the consolidation. From the following abstract, the most significant change that appears is the sudden increase in interest charges from 14% of the income in 1901 to 25% in 1903, with practically the same direct operating expense.

Percentage Distribution of Income

	1901*	1903**	1911***
Total receipts	100.00	100.00	100.00
Direct operating expenses, including maintenance and insurance but excluding taxes and depreciation	52.30	51.90	54.02
Operating expenses, including maintenance, insurance, taxes and depreciation	59.35	60.75	65.03
Gross corporate income	40.65	39.25	34.97
Interest and other deductions from income	14.22	24.52	26.29
Net corporate income	26.43	14.73	8.68
Sinking fund contributions	1.63	1.98	4.67
Net surplus for dividends	24.80	12.75	4.01

*Year prior to consolidation.
**First full year of operation under consolidation.
***Present conditions.

Referring to the graphical income record (Fig. 89), there are two distinct periods of operation in this exhibit: 1st, previous to 1907, when the greater part of the power consumed was generated by the operating companies; and 2d, the period subsequent to 1907, in which power has been largely purchased as later explained (page 329). These two periods are not comparable unless allowance be made for the interest charge on power plant, which amounted to about 3% of the income in 1911.

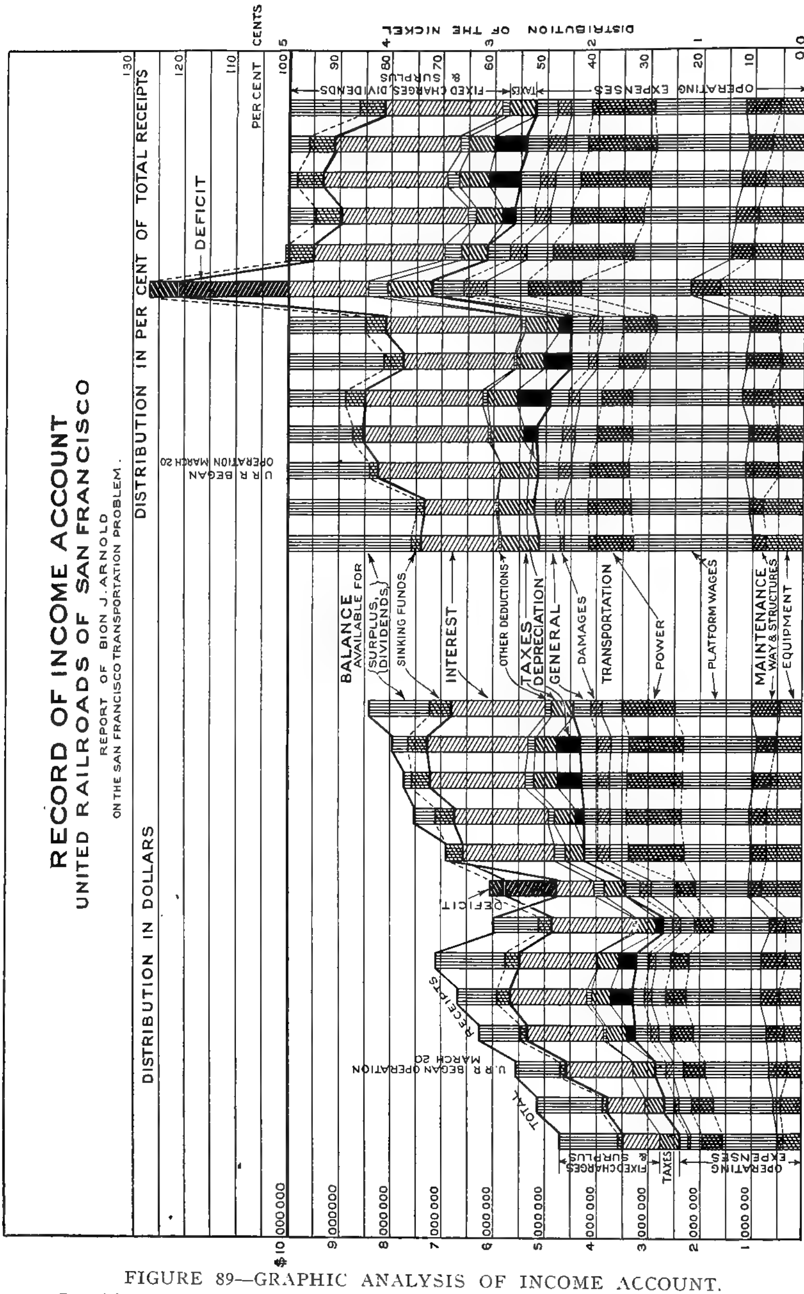


FIGURE 89—GRAPHIC ANALYSIS OF INCOME ACCOUNT.

In this diagram, the total income is built up with the major accounts traceable from year to year by diagonal lines. Increases are indicated by the divergence of these reference lines, and *vice versa*. Annual growth is indicated by the total height. Distribution is shown in *per cent of total income*, so that the various years may be compared on the same basis; this indicates also the distribution of the nickel fare. Sinking fund payments are shown here as a direct charge against annual surplus. The considerable increase in net income for the year 1912 is noticeable, partly due to absence of a depreciation reserve.

Formerly, these fixed charges were all included in "interest on investment;" but now in operating expenses under "cost of power."

On the basis of this readjustment, direct operating expenses in per cent of income (including maintenance and insurance but excluding taxes and depreciation) have decreased since 1907 to practically the same level today as in 1900—51%. However, this rate also decreased from a maximum of 51% in 1900 to 45% in 1905, yielding the highest net earnings in the Company's history—about $3,000,000—in the latter year.

Dividends. The Company's financial difficulties of 1907 and 1908 were undoubtedly increased by its heavy dividend declarations, especially in the first quarter of 1906, when a total of $1,020,000 was declared. In addition, 2% or $400,000 was paid after the fire, a total of $1,420,000 for the fiscal year, or 7.1% on the preferred stock. The net surplus for 1906 was $877,146, which would have enabled the Company to declare a dividend of 4.38% on the preferred, so that approximately 39% of the dividends must necessarily have been paid from *accumulated surplus.* This practice has also been followed in 1908 and 1910.

By reason of this relation between surplus and dividends, no attempt has been made in this report to indicate *true* profit and loss for the various fiscal years. For the period 1903 to 1911, inclusive, it appears that the total dividends as reported by the Company aggregate over $860,000 more than the cumulative *surplus from operation,* considering depreciation as an *actual cash reserve* out of income. This means that unless corresponding credits were properly available for the stockholders from sources other than actual income, these excess dividend declarations could not have been founded upon true earning capacity of the operating property.*

DIVIDENDS PAID

First preferred, 7 semi-annual dividends at 3½%—July, 1908 to July, 1911	$175,000 each
Preferred, 7 semi-annual dividends—December, 1902, to	
December, 1905, at 1.2 to 2.0% ....$240.000 to	400.000 each
March, 1906, at 3.6%	720,000 each
December, 1906, at 2.0%	400,000 each
Common—	
March, 1906, at 1.5%	300,000 each

The distribution of expenditures (Fig. 90), offers a graphical comparison of net earnings as against interest and sinking fund; dividends are of course to be met from the balance. In only one year, 1907, did a deficit occur.

* See discussion of sinking fund equities, page 317

Renewals and Depreciation. During the past two years the Company has modified its policy regarding reserves by charging depreciation directly to profit and loss. The proper treatment of depreciation is of great importance, and it is a radical error to consider it as other than a direct annual charge against income, prior to the declaration of net earnings. Unless this profit and loss account is segregated on the balance sheet so as to clearly show depreciation reserve, it is impossible to determine the extent or character of the funds available therefor. A stated percentage of the gross earnings should be set aside annually in the nature of a floating asset or reserve that could be readily converted into *cash available for replacements* when the necessity arises.

Taxes and other Obligations. Under the terms of the various franchises, amounts varying from two to five per cent of the receipts of many of the lines accrue to the City annually in the form of a usage tax. Some of the important lines, such as Market Street, bear no tax under the ordinances. The State now receives a fixed tax of 4% of the gross earnings, *while the City receives less than 1%,* including all obligations imposed, or less than one-fifth of the total taxes. (See Chapter 19, special report on settlement of franchise tax.)

The electrification of the United Railroads cable lines in 1906 was permitted only upon condition that ornamental poles be erected on Market Street to Valencia Street, and on Sutter Street to the west line of Van Ness Avenue, and that electric lights be installed and maintained by the Company with under ground conduit distribution.

Practically all franchises stipulate that the Company provide and maintain paving within and between tracks, and for two feet outside of the outer rail.

A statement of the Company's obligations for the year 1911, exclusive of costs of paving and free transportation of municipal and federal employees, follows:

		Per Cent
State, 4% gross earnings	$315,445	80.00
City and County, non-operative property tax	9,955	2.52
Percentage tax upon receipts	41,600	10.55
Car licenses, etc.	8,600	2.18
Street lighting	13,000	3.30
Federal income tax	5,700	1.45
TOTAL*	$394,300	100.00

* This total is in slight disagreement with the statement of total taxes in the Company's Income Account—$404,000.

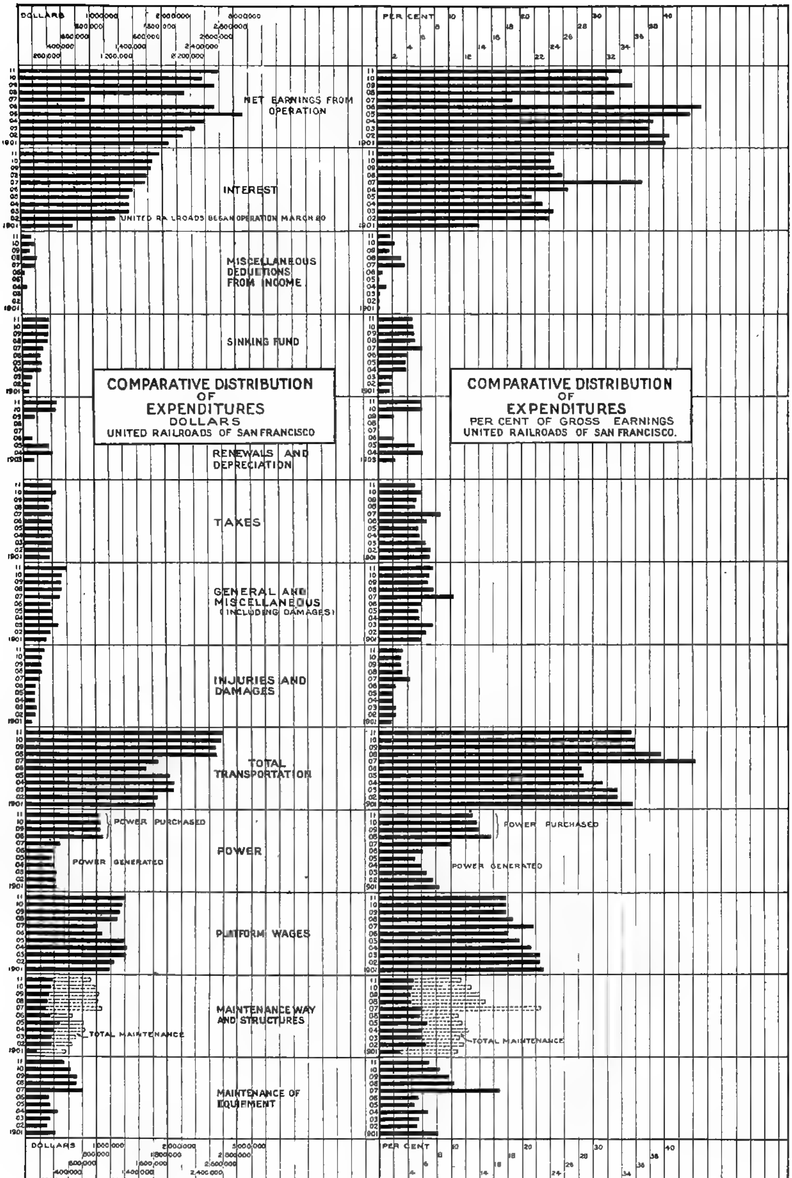


FIGURE 90—DISTRIBUTION OF EXPENDITURES.

In order that the important sub-accounts may be compared, year by year, these have been plotted to the same base line. *Gross earnings from operation* have been employed here instead of total income, in order to give an accurate comparison from an *operating viewpoint.* The difference is small —about one per cent. Total maintenance is indicated by dotted lines. Change in motive power during the decade is clearly reflected in the power account. Depreciation is here treated as a cash reserve, reducing net earnings, and not as a charge against Profit & Loss.

Referring to Fig. 90, it will be seen that taxes have remained *practically stationary in amount* since 1900, and therefore have decreased in percentage to 5.12% of the gross earnings at the present time. The percentage in Chicago is twice as great, including City's share of net profits, and nearly twice in Baltimore, where no City's share exists.

Injuries and Damages are comparatively low and have increased only slightly in spite of the higher speed of electric operation. Damage payments averaged about 2% up to 1906, during which period there was mostly cable operation, as compared with about 3½% since the electrification when the electric car mileage has been approximately 95% of the total. This increase is doubtless due to increased speed of operation, which is 12% higher now than in 1907. However, this average percentage is low compared with other cities—about one-half of Chicago's damage account for the year 1911.

Table 49, an analysis of the accident account, indicates that while the *proportion* of accidents to persons has increased since 1908, the *number of passengers carried per accident* has also increased from 78,000 to 91,000—a very creditable result.

Maintenance. While this subject is discussed from another standpoint in Chapter 15, the graphical record, Fig. 90, offers a direct substantiation of the results shown in that chapter. Maintenance of equipment has continually decreased during the last four years from the 1907 maximum which resulted from rehabilitation following the fire but as stated, the present good condition of the equipment, as a result of this high maintenance and the increased efficiency in the shops, would appear to warrant this reduction, especially in view of the fact *that the maintenance expenditure per car mile is relatively high as compared with Eastern cities.*

However, maintenance of track and roadway has remained abnormally low, though increased from $630 per mile of track in 1903 to about $1,100 per mile in 1911; but even with this increase, deferred maintenance and renewals have accumulated to such an extent that parts of the track and roadway are now in a very poor condition, as evidenced by detailed inspection (see Chapter 15). For this reason, it is probable that the appropriation for *track and roadway* will have to be increased to at least 5% of the gross earnings (which for 1911 would have amounted to $1500 per mile, or 1.6 cents per car mile) and that *way and structures* appropriation should total 6% of the gross earnings, or about $1,800 per mile of track. This will compare more favorably with the known results of established properties elsewhere.

The total cost of maintenance (11.47% of the gross earnings in 1911) appears hardly sufficient for the immediate future, and at least 12.5% of the gross earnings should be set aside until the property is built up; any reduction in the cost of equipment maintenance accruing to the track maintenance account.

Platform Expense. Tracing the history since 1901 of platform wages in per cent of gross earnings, it appears from Fig. 90 that this important part of transportation expense was no greater in 1911 than in 1903-4; and when expressed in per cent of gross earnings, platform wages had continuously decreased from 23% in 1901 to 17.85% in 1911, although an *increase in the average wage per man* had occurred since 1908. The average wage is now the same as before the fire, 26.9 cents per hour, with a maximum of 33 cents after 8 years' service. This decrease in platform percentage does not *necessarily* indicate a proportional reduction in service, because of the effects of higher car capacities and speeds and better schedules; but in this case there is every indication of curtailment in car hours—that is, the equivalent of service—at least from 1903 to 1906, if not during recent years.

The relative apportionment of wages paid to all railway employees has been illustrated in Chapter 4, Fig. 20, and there set into contrast with the proportional expenditures for service, for Company return, and for taxes respectively. This exhibit is of unusual interest, in that *all wages of $1500 per annum or under are included* as well as platform expense alone, so that the true share of labor in the railway business may be fully appreciated; platform wages evidently amount to but little over one-half of the total.

For every $100 of income, $35 is applied by the Company to the payment of fixed charges, sinking funds and dividends; $30 is required for operating expenses other than wages; and $30 pays operating labor, of which platform men alone receive $18, approximately. Only $5 goes to the public in the form of taxes; and finally, less than $1 reaches the City directly.

Power. The result of purchasing power is apparent by comparing the last four years with the period prior to the fire. Thus, the proportional expense for power, increased from about 5% in 1905 to 16% in 1908, thence decreasing to 13% in 1911. (Fig. 90.) The high cost of power in 1908—5.51 cents per car mile—due to conditions of supply detailed in Chapter 15, has since been reduced to 4.45 cents per car mile, with 70% of the total power supplied by the Sierra & San Francisco Power Company. Adjusting this power account for fixed charges, the cost

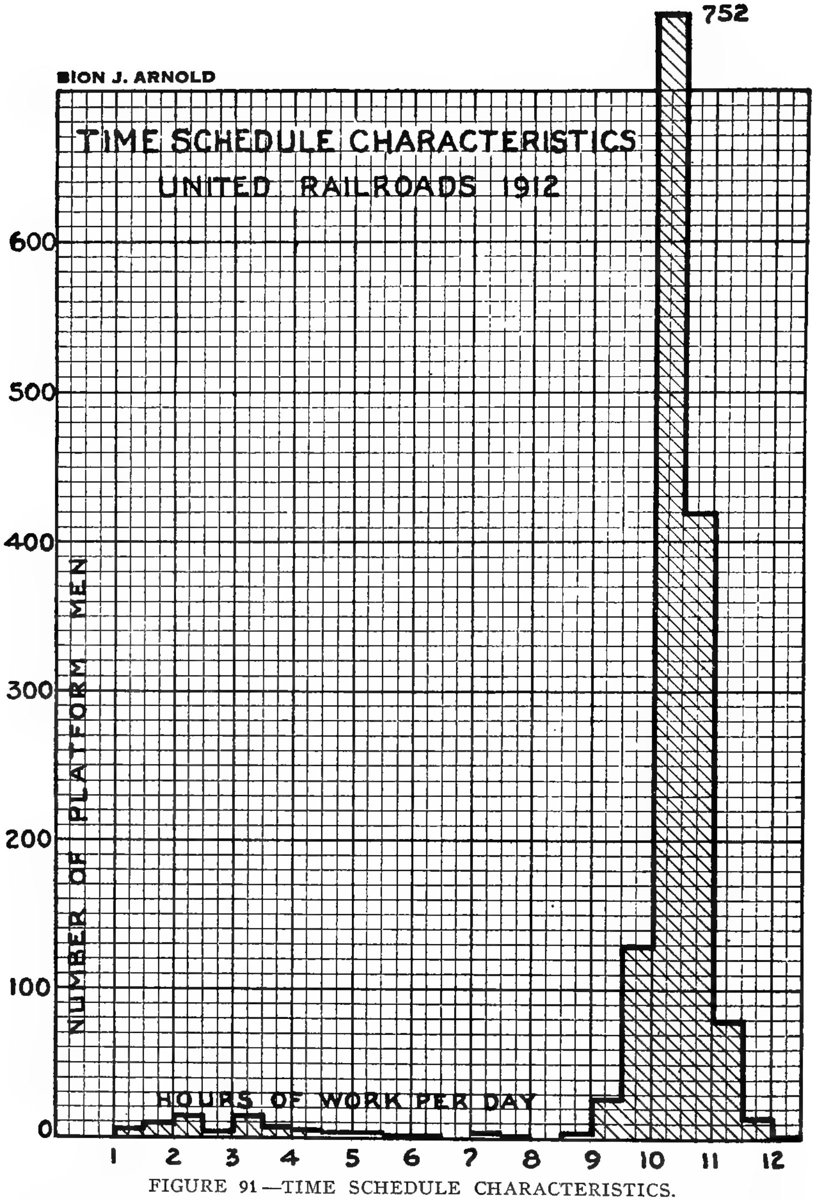


FIGURE 91—TIME SCHEDULE CHARACTERISTICS.

The net result of a railway time schedule in giving every man a full day's work and pay as far as possible is clearly indicated here. Out of 1,510 trainmen assigned to "regular" and to "swing" runs (*i. e.*, "trippers" or extras), 752, or practically half, work between 10 and 10½ hours; and only 5½% of the men are paid for less than nine hours' work. The schedule is thus constructed upon the basis of practically a 10-hour working day, and aims to complete the day's work within 12 hours. No minimum wage exists, the men being paid for the time they work. The shorter the average day's work, the more difficult it becomes to provide swing runs for rush hour service without increasing operating expense unduly.

of power per car mile comparable with former years would be about 3.5 cents, which is considerably higher than in level cities.

That much of this is due to topographic conditions is shown by the high power consumption, averaging 4.8 k.w.h. per car mile in 1911. In level cities such as Chicago this same equipment could be operated for possibly 3.5 k.w.h. per car mile.‡ And as grades are unavoidable in San Francisco, this suggests the great necessity of the lightest possible equipment.*

Growth of Traffic. From the monthly traffic record, Fig. 92, two facts are apparent—1st, the great loss due to the fire and particularly to the strike; and 2nd, the small seasonal variation characteristic of San Francisco.

When reduced to a basis of a uniform month—30.4 days—the variation between spring and fall is inconsiderable—only 10% of this passenger traffic. One noticeable result of the first three years of the Company's operation is that the car mileage operated —a direct reflection of the service standard—did not at all keep pace with the increase in traffic; although since 1908 conditions have improved in this respect.

The great stability of the business of urban transportation is illustrated by reference to the curve of bank clearings superimposed upon this record. Here the fact appears that railway traffic was *not appreciably disturbed* by the financial depression of 1907-8 in its rapid recovery from the effects of the strike. Of the two great catastrophes, the strike resulted far more seriously, causing a maximum drop of 15,000,000 passengers in one month as against a maximum of 8,500,000 in one month as a result of the fire. Assuming that the average rate of growth in earnings from January 1903 to April 1906 had continued, the total loss in earnings during the fire-strike period amounted to nearly $5,000,000. In other words, had the fire and strike not occurred the gross earnings in 1907 would probably have been $7,865,000 instead of $4,745,000, or about the same as in 1911. Four years have thus been lost due to these disasters, and in addition, a *permanent set-back* of over $1,000,000 per year in gross earning capacity of the property.

The transfer traffic in San Francisco has reduced since 1904, when 48 out of every 100 revenue passengers used transfers as against 43 at present. This reduction is no doubt due to the validation of transfers on cross-town lines instead of issuing

‡ In Chicago the power consumption per car mile was 3.67 k.w.h's for the year 1911.

* It is probable that the Company could well afford to retire to the more level routes much of the equipment now operating on heavy grade routes rather than to incur this great expense for power. The class 1550 cars, of which there are 200, are particularly unfortunate in this respect, weighing 56,000 lbs., as against weights of 46,000 to 48,000 lbs. on the Geary and Sutter Street lines.

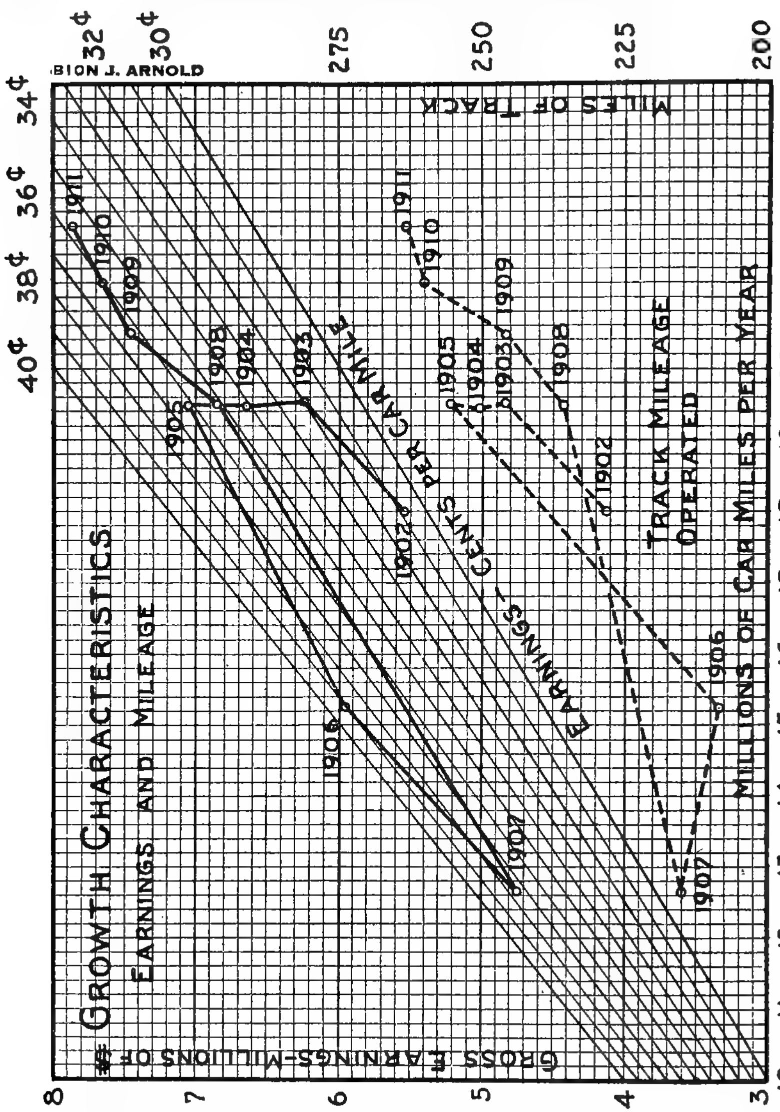


FIGURE 92—GROWTH CHARACTERISTICS.

In this diagram, one point indicates for each year the earnings, car mileage, and also earnings per car mile (shown by the diagonal reference lines). The direct rise from 1903-5 shows that the earnings *increased* while the car mileage remained practically the same. From 1908 on, earnings and car mileage have increased proportionately—*i. e.*, practically following the diagonal of 36c per car mile. Both should increase proportionately, unless a radical change in size of equipment should take place. In each of the two respective periods noted—1903-5 and 1908-11—practically the same character of equipment was operated. Similarly, track mileage has shown erratic growth as compared with car mileage operated.

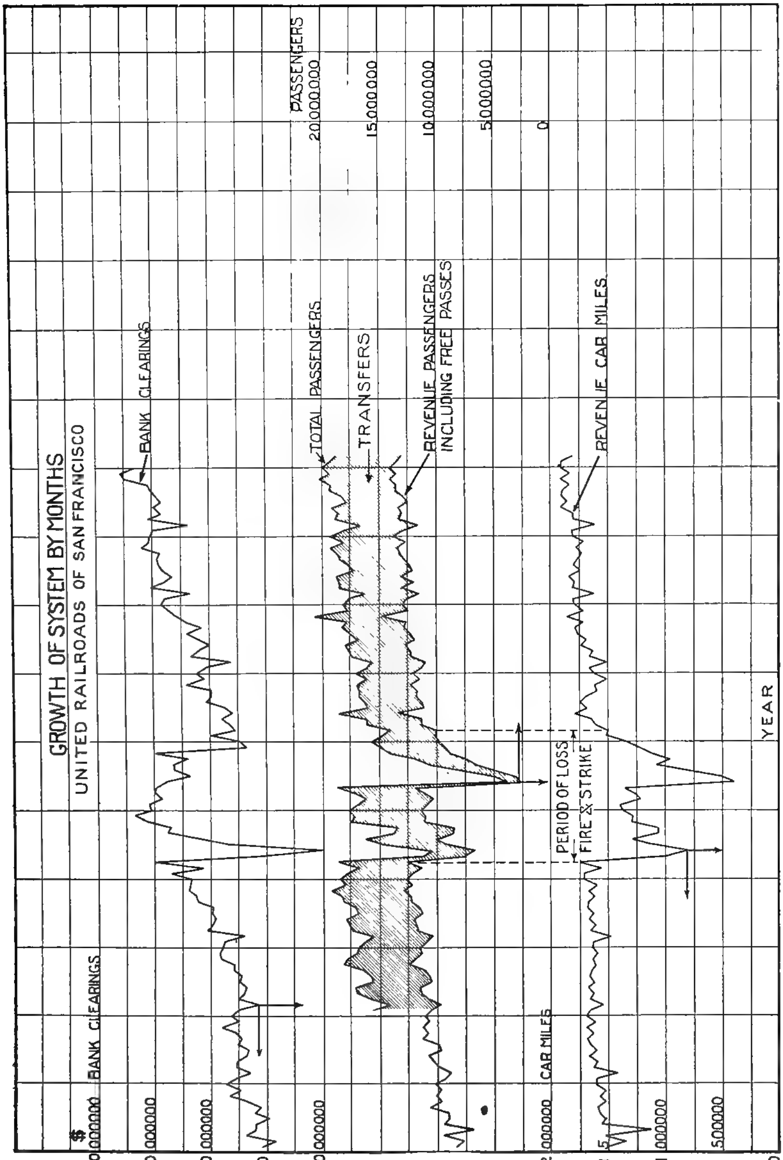


FIGURE 93—RECORD OF MONTHLY GROWTH OF SYSTEM.

The monthly record of traffic reveals many facts not apparent from the annual fiscal statement. This graph indicates the relation between traffic and service (as reflected in car mileage). Variations are largely due to unequal lengths of months, except under the abnormal disturbances of 1906 and 1907. Seasonal variation is much less pronounced than in Eastern cities. From 1902 to 1905 (inclusive), service (car mileage) did not keep pace with the growth in traffic, but since 1908 there has been some improvement in this respect. Railway traffic was not appreciably disturbed by the financial depression in its rapid recovery from the effects of the fire and strike.

transfer on transfer as formerly. The transfer facilities afforded by the Company are now very liberal as compared with other cities, with the single exception of Chicago, where unusual conditions obtain to produce a transfer traffic as high as 70% of the cash fares.

Average Fare. During the last decade the dilution of the 5-cent fare from reduced rate school tickets and free passes to Municipal and Company employees has amounted to only about 1% under normal conditions of operation. Transfer traffic now results in an average fare for all classes of about 3.5 cents. This, however, has no special significance so long as a unified system is maintained; but with transfer between foreign lines such as Geary Street an actual dilution of income per passenger takes place through splitting of the fare which must be recognized.

Analytic Ratios. Subjecting the operating records to a final analysis by means of various ratios, it is possible to trace the relative efficiency of operation from year to year and especially in comparison with known standards of other cities, if in this comparison conditions peculiar to San Francisco are taken into account.

The abnormally high earning capacity noted elsewhere is reflected in all of the ratios—gross earnings per capita, per car mile, per car hour, per car operated, and per mile of track. With earnings of $30,000 per mile of single track, San Francisco equals or exceeds cities many times its size. This is partly due to the fact that the system has not been extended to keep pace with the population, and partly to the exceptionally high riding habit, which results in 1911 in earnings of over $18 per capita for the United Railroads alone; or, including all systems, about $20 per capita.

While the relative utilization of the present trackage—84,000 car miles per mile of track—appears high for a city of this size, a shortage of cars is indicated by the low average cars per mile of track as compared with other cities (*i. e.*, the average distance between cars in San Francisco should be a minimum, due to the prevailing short haul and high density). Therefore the usage of present track should be even higher than above recorded; and this has been confirmed by traffic counts. This shortage in cars is further reflected in the high average car loading—10.15 passengers per car mile—exceeding that of any other city. Apparently, this loading had decreased since 1909, but as this was largely due to known increased speed of operation, the actual conditions are better shown by the ratio "total passengers per car hour," which have increased materially since 1909. This

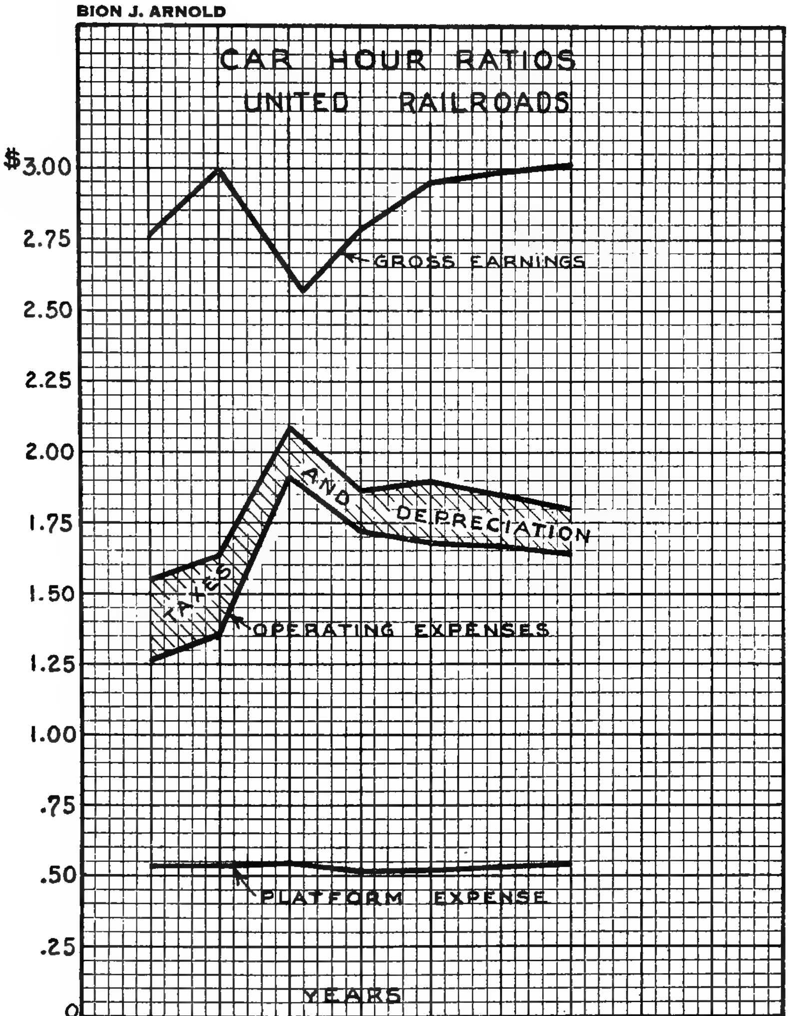


FIGURE 94—CAR-HOUR RATIOS, EARNINGS AND EXPENSES.

The car-hour offers the best basis for analysis of operation and schedules with reference to platform labor employed, and automatically takes into account variations in operating speed. From this record it appears that while both operating expenses and earnings increased between 1905 and 1911, platform expense per car hour has remained practically constant since 1905, ranging between 52 and 55 cents. This represents the average wages per car crew. From 1908 on, the earnings have increased while the operating expense has decreased slightly, indicating an increasing density of traffic and possibly curtailment of service.

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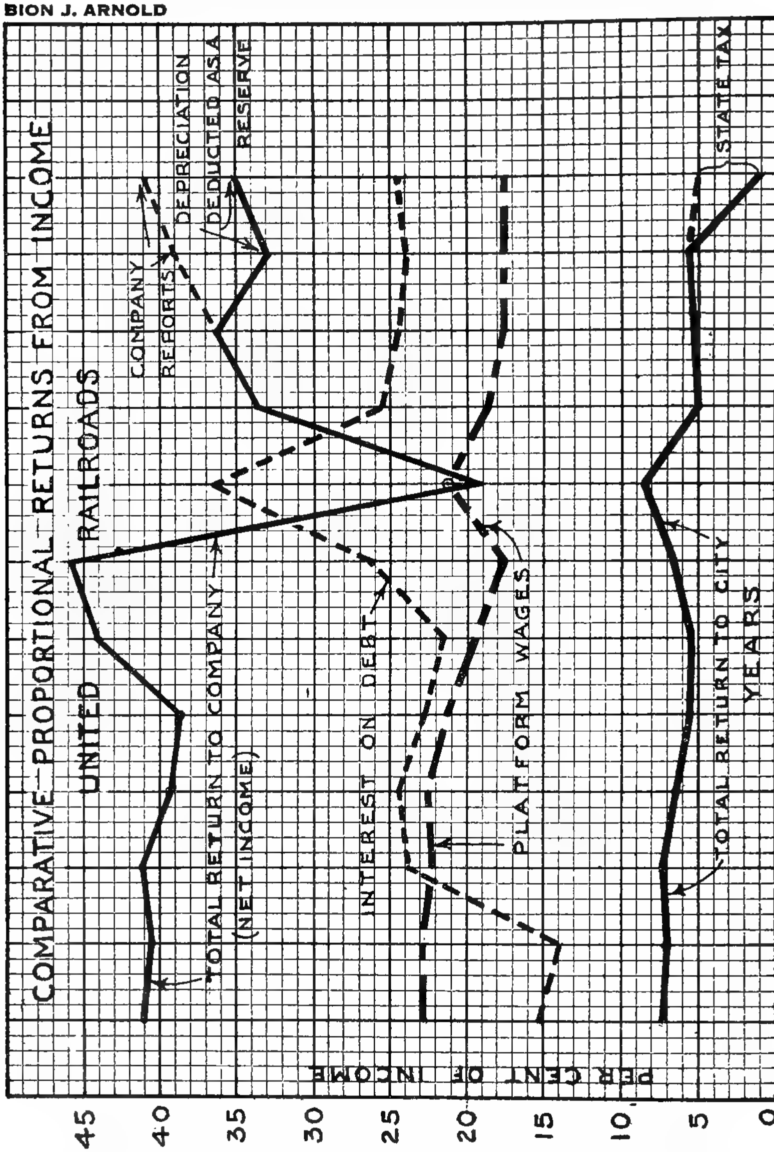

FIGURE 95—COMPARATIVE PROPORTIONAL RETURNS FROM INCOME.

Analyzing the record of income share to Company, Labor, and City for the past twelve years, it appears that while interest on debt has largely increased, the Company's total share has decreased by about 6 per cent. But its depreciation has not been deducted as a cash reserve, then the Company's share has remained constant while that of Labor and City has continually decreased—the latter fully one-third, even assuming State taxes as a form of return to the City. There seems little doubt that the City might very properly receive a more equitable return.

ratio compensates automatically for variations in speed. Again, to this increased loading is very largely due the abnormal earnings per average car operated—$13,000 per car per year—the highest of any urban system in the United States.

While high earning ratios are to be expected from short-haul and high density travel, the excessive earnings here recorded would not be warranted until the operating equipment per mile of track had been increased and the trackage of the system largely extended, for both have been shown to be necessary by the traffic survey of the city and the study of its needs. The average fare has not been materially diluted below 5 cents, nor is the transfer traffic abnormal, so that the unit of income has been reasonably preserved as compared with other cities.

It is true that direct expenses of operation are relatively higher than in Eastern cities, which justifies to a certain degree these high earning ratios; yet an operating ratio as low as 54% (including maintenance and insurance but exclusive of taxes and depreciation) certainly indicates that advantage is being taken of conditions in this city to produce abnormal net income from the present property by deferring the extensions and improvements to service recommended herein.

Proportional Income Share. This analysis may appropriately be concluded by observing the changes in proportional share from income accruing during various years to the principals in this business of urban transportation—City, Labor, Company. Fig. 95 shows that immediately after the consolidation of 1902 interest charges increased abruptly, and although rising still further during 1906-7, eventually returned to the previous level of 1903 after nearly a decade.

The Company's return is represented by net income, which was insufficient during 1907 to meet fixed interest charges. If depreciation had been charged as a *cash reserve against income,* the Company's return would have been reduced from 41 to 35% during the decade.*

Trainmen's share has reduced as previously explained.

The City's share has suffered the greatest reduction, especially during the last year as a result of the change in basis of State taxation. To compensate for this general decrease in the share of the principals, a corresponding increase in other items of expense has taken place, viz., power, damages and depreciation.

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* This illustrates the great importance of proper treatment of the various reserve accounts. If depreciation has not been handled as a cash reserve from income, then the Company's share has increased rapidly while the others have suffered decrease.

CHAPTER 15

CONDITION OF PHYSICAL PROPERTY

Results of Property Inspection
Analysis of Maintenance of Rolling Stock

To obtain definite data on the extent and condition of the railway physical property, its sufficiency for transit purposes and the standards of maintenance, all of which are important elements in any equitable settlement between City and Company, a detailed inspection of all street railway properties operating in San Francisco was made. In this chapter are included the summarized results of the inspection, covering 242 miles of track, 650 special work layouts, paving, buildings, shops, power equipment, and rolling stock, showing the magnitude of the rehabilitation work which must be undertaken in the near future. While sufficient for a general indication of conditions, the results of this inspection of course cannot be too rigidly interpreted since the effort and cost of an accurate determination would be warranted only in case of a detailed appraisal.

SUMMARY OF CONDITION AND REHABILITATION

1. Referring to the appended classified summaries, it appears that about 37 miles, or 16% of the total trackage in San Francisco, is in such depreciated condition that rehabilitation thereon should be commenced immediately. In addition, 61 miles of inadequate track construction exists, of which 34 miles requires early renewal and 29 miles on unimportant lines is in good condition and will only need renewal later. From the above it may be said that about 70 miles of track represents the magnitude of the rehabilitation work that must be undertaken in the near future in addition to 4 miles of adequate rail section needing extensive repairs.

2. Out of approximately 650 special work layouts, exclusive of those in car houses and yards, 238—about one-third of the total—are in good condition but require slight repairs, and 131 layouts, or 30%, are in such shape as to require extensive repair or renewal in the near future.

3. Of the 185 miles of single track paved, there is approximately 40 miles, or 22% of the total, which will be renewed in the

course of necessary track reconstruction as above specified; and in addition, 23 miles along good track, requiring repairs or repaving.

4. Of the 661 cars in operative condition, about 20% are of obsolete type and inadequate for service in the congested district. Fully half of the cable equipment is entirely too small for downtown service. There are in all 254 electric cars, or 40% of the total, which are either inadequate for downtown service or should be rebuilt into the prepayment type if run on congested streets.

5. There are no fire-proof car houses, the only protection consisting of hose-reels and buckets, which are insufficient when judged by modern standards. Car-cleaning facilities are fairly adequate. The car storage capacity is insufficient for the new 1912 equipment, and new car house construction is necessary, especially if extensions are undertaken. The locations are fairly well suited to the present system of routing.

6. The Company operates a good car shop which contains facilities for proper maintenance and even the construction and reconstruction of car bodies. In fact, it would not be impossible for all the cars needed for the immediate future to be built in these shops.

7. Owing to the transfer in 1910 of the main electric generating plant at North Beach to the Sierra and San Francisco Power Company, the only electric plant owned by the United Railroads is the obsolete station at Bryant Street. In case of complete breakdown of the Power Company's hydro-electric supply, the North Beach power station, in addition to the contract supply from the City Electric Company, would be sufficient to operate the system. There is sufficient reserve capacity in both power and sub-stations for present but not for future needs and therefore the power system must be included in any program of extension.

8. As the cable system will probably never be much enlarged, the present cable power equipment may be left out of consideration.

9. It is apparent from the above that in order to develop an adequate transit property for San Francisco even exclusive of extensions, a very large amount of rehabilitation work needs to be undertaken immediately by the United Railroads, in order to forestall excessive maintenance and depreciation later.

10. It may, of course, be truly stated that a large share of this deferred maintenance and rehabilitation work may be attributed to the unexpected financial difficulties due to the direct loss of about $5,000,000 gross earnings for the United Railroads system alone, resulting from the fire and strike. However, this work re-

mains to be done, and must be financed if the traction properties of San Francisco are to keep pace with the city's rehabilitation and growth.

11. Taken as a whole, the lines of both the California Street Cable Railway and the Presidio & Ferries Railway are in good condition, and comparatively little rehabilitation work will be necessary in the near future. The property of both roads (with the exception of the rolling stock of the Presidio & Ferries Railway, which is inadequate, and the car barn of the California Street Company, which affords insufficient fire protection) is satisfactory. Any expansion of the Presidio & Ferries system will require increased facilities in car house and power plant, unless the City purchases power when it takes over the road in 1913 or thereafter. Recommendations for an improved type of car may be found in Chapter 8.

DETAILED RESULTS OF INSPECTION

UNITED RAILROADS OF SAN FRANCISCO.

The operating property will be taken up under the following heads:

Track	Power and Distribution System
Special Work	Car Houses
Paving	Car Shops
Rolling Stock	

Electric and Cable Track

In order to check approximately the track mileage of record, Table 54, an inspection of all the lines was made, for determining location, condition, and type of construction. The length of track found in this inspection within the city limits was 238.62 miles of single track, about 2% less than the United Railroads records. In view of the approximate method of measurement adopted—*i. e.*, scaling from verified trackage map—United Railroads mileage may be considered accurate for the purposes of this report.

Condition of Track. Under this head is considered only the actual physical condition of the rail and joints—neither depreciation nor the adequacy of the rail being taken into account, except in cases where the rail is worn to such an extent as to make renewal necessary immediately or in the very near future.

All of the track is divided into the following five classes of condition, summarized in Table 54:

Class I. First class condition. No serious maintenance work necessary in the near future.	110.00 miles.
Class II. Good condition but in need of slight repairs from time to time. This includes track which is slightly corrugated, with some joints a little battered or with sections having poor sub-structure. Such track is in good condition, but cannot be considered in the first class.	52.66 "
Class III. Fair condition but in immediate need of considerable maintenance work. Track in poor alignment, rail having slight surface kinks, joints slightly hammered or out of line, rail elevation uneven. Track listed under this head is in fair condition, but due to poor upkeep in the past, considerable work must be done to bring it up to a reasonable standard.	37.79 "
Class IV. Poor condition and in need of early renewal. Track and joints battered and out of line, making track rough and uneven; rail elevations variable; wheel flange starting to run on groove. Track in this class is so far deteriorated as not to justify extensive repair.	27.03 "
Class V. Very bad condition and in need of immediate renewal. Track very much battered and out of alignment; joints shattered and out of line; flange cuts deeply into groove or wagon tread.	10.30 "

Service Sufficiency. Considered from the standpoint of adequacy for modern high-speed equipment, it seems that for the usual street conditions encountered, no rail lighter than the present standard 9-inch 106-lb section should be used. This would retire the following kinds of rail, which are listed in the approximate order of their adequacy:*

1.	96-lb 7″ trilby rail	1.49 miles
2.	85-lb 9″ girder rail	51.63 miles
3.	74½-lb 8″ tee rail	2.12 miles
4.	80-lb 8″ slot rail	7.33 miles
5.	72-lb center bearing rail	11.86 miles
6.	Miscellaneous light tee rails	33.47 miles
7.	70-lb 4⅜″ girder rail	14.64 miles
8.	51-lb 4″ girder rail	2.57 miles
9.	51-lb sheared omnibus rail	3.41 miles
	Total single track	128.52 miles

*There are numerous sections which are not separately indicated in this table, inasmuch as they approximate very closely some one of the sections included.

Of these all but the first three sections are inadequate for first class track on paved streets. Sections 1, 2 and 3 are too light, but so far they have stood up very well under comparatively heavy traffic and for the most part are in good condition. However, on account of their light weight, track laid with these sections, which is found to be in need of extensive maintenance work, could be rerailed with standard sections with the least ultimate expense.

Considered from the standpoint both of condition and adequacy, the situation is as follows:

GENERAL SUMMARY OF TRACK IN SAN FRANCISCO—CABLE AND ELECTRIC.*

			Miles, Total.	Miles, Electric.
A†	Adequate rail in good condition		94.72	92.97
B	Rail adequate for lighter lines, in good condition		41.57	41.57
C	Inadequate rail on unimportant lines, in good condition		16.05	16.05
D	Adequate rail needing repairs		3.80	3.80
E	Inadequate rail in good condition on important lines—should be renewed	11.17		9.50
F-G	Inadequate rail in need of extensive repair—should be renewed	33.99	82.49	28.30
H	Track needing early renewal on account of poor condition	37.33		32.02
			238.63	224.21

SUB-CLASSIFICATION—ELECTRIC TRACKS ONLY IN SAN FRANCISCO.*

	Class I	Class II	Class III	Class IV	Class V
Adequate rail	74.56	18.41	3.80	.40	....
Rail adequate except for lines of very heavy traffic	27.34	14.23	7.47	4.08	.63
Inadequate rail on lines of very light traffic	8.94	7.16	20.83.	18.19	8.72
Inadequate rail which should be replaced	....	9.44			
	110.84	49.24	32.10	22.67	9.35

Special Work. An examination of the special work (September, 1912) on the United Railroads lines shows that there are approximately 654 layouts in the City of San Francisco, exclusive of those in the car houses and yards. Of these there were:

26 solid manganese type,
416 hard-center type, and
212 built-up layouts.

*For detail by streets, see Table 54, Appendix.
†Letters refer to classification by streets, Table 54, Appendix.

The layouts which are jointly used with other companies (included in the above) were as follows:

25 solid manganese layouts,
68 hard-center layouts,
46 built-up layouts.

A tabulation showing the various types of layouts, separated into five classes of condition, is included in the Appendix, Table 54.

In view of the fact that the built-up special work is inadequate for heavy city traffic, the built-up layouts which are listed under Class 3 (see Appendix) are considered in need of renewal in the near future, rather than in need of maintenance work.

Summarizing the results of this inspection from the standpoint of future rehabilitation, there were:

285 layouts in first-class shape;
238 layouts, slightly battered or broken. These can be repaired in many cases by electric welding, and in others by improving the substructure.
47 layouts which were in a badly battered condition, and in need of a great deal of maintenance work either in building up the substructure or in repairing the layout, or both.
84 layouts in poor condition which should be immediately replaced.

654 total.

As a general rule, it was found that the special work was in better condition than the track, particularly on lines laid with light rail.

Paving. The results of paving inspection may be summarized by the following classification:

Class I—Either asphalt or block paving in first-class condition.

	Asphalt	Block
Double track	21.6 mi.	15.88 mi.
Single track	3.0 mi.	4.94 mi.

Class II—Asphalt—fair condition, but in need of minor repairs along brow.* Block paving—uneven but intact:

	Asphalt	Block
Double track	18.5 mi.	14.3 mi.
Single track	1.9 mi.	5.45 mi.

*Brow paving is defined as the strip of paving next to the rail.

Class III—Asphalt—poor condition, needing extensive repairs along the brow and minor repairs in the middle section. Block paving—very uneven:

	Asphalt	Block
Double track	7.24 mi.	1.10 mi.
Single track	1.75 mi.	....

Class IV—Very bad condition and in need of repaving:

	Asphalt	Block
Double track	4.4 mi.	1.13 mi.

Much of the poor pavement is found along lines which will have to be relaid or extensively repaired, and the repaving would therefore not be warranted until the track is rehabilitated. This is shown by the following summary classified according to joint condition of rail and pavement, in miles of single track. The third column represents paving work to be done exclusively of track rehabilitation:

	Asphalt Paving			Block Paving		
	Total in San Francisco.	Joint Renewal with Track.	Needing Separate Renewal.	Total in San Francisco.	Joint Renewal with Track.	Needing Separate Renewal.
Class I.....	46.20	1.62	...	36.70	10.55	....
Class II.....	38.90	7.24	....	34.05	14.35	....
Class III.....	16.23	3.22	13.01	2.20	....	2.20
Class IV.....	8.80	3.22	5.58	2.26	....	2.26

Rolling Stock*

Of the 620 electric cars in commission, only 100 may be classed as modern, prepay equipment. Of the remainder, 249 are fairly well adapted to the downtown traffic, but may be much improved by the means indicated in Chapter 9. The 123 non-prepay cars of the 1300 class are rapidly becoming obsolete, and are unsuited for service on the principal lines unless they are rebuilt into the prepay type. Thirty of the cars used at present on the San Mateo and Cemetery lines are suited only for long-haul or interurban traffic.

The remaining 118 cars, all of the old "California" type, are obsolete and unsuited for service within the congested district where many of them are at present operated. These cars should be retired from service, or placed on unimportant lines. Of the cable cars the five "trains" now operated on Pacific Avenue are obsolete, and the 26 half-open, half-closed cars of the Powell Street type are too small for the traffic they are called upon to carry. The maintenance of the rolling stock is discussed elsewhere in this report.

*See detailed equipment sheet, Table 29, Appendix.

Car Barns

The United Railroads owns 13 car houses, of which 10 are used for electric and 3 for cable cars. Of the 10 structures housing electric rolling stock, two, known as Kentucky Street and Twenty-ninth Street are, unless reconstructed, unsuited for the present standard cars, and are now used only for the old equipment.

The total capacity of the 8 barns used for the large equipment is 461—45-ft. cars, allowing 47 ft. per car average. The combined capacity of the Kentucky and Twenty-ninth Street barns is 100—34-ft. cars, making the total capacity for the ten barns 561 cars. The Company owns 612 electric cars, and it appears, taking their length into consideration, that the present car house facilities are just about capable of taking care of the entire equipment. However, upon the delivery of the 65 new cars recently ordered, it will probably be necessary to provide another car house.

The combined capacity of the cable car barns is 102 cars, based on an allowance of 34 ft. per car. This is more than sufficient to house the present operated cable equipment, which amounts to only 49 cars.

With the exception of the Haight Street and Twenty-ninth Street car houses, all have adequate facilities for repair and inspection work as well as car cleaning. All barns are supplied with facilities in the way of chain hoists and tools to do comparatively heavy overhauling work in case of emergency, and two, the Twenty-fourth Street and Turk Street car houses, are supplied with air hoists and machine tools. Thus, with the exception of three, all of the car houses are comparatively well equipped except with regard to fire protection. The only protection against fire is afforded by hose lines fed from two-inch pipes, and by fire buckets. None of the car houses are provided with sprinkler systems. The track layout at two of the barns, Geneva Avenue and Twenty-fourth Street, is such that cars could probably be removed rapidly in case of fire, but at the remaining car houses there are only from two to three tracks leading out of the barns, which would make removal of the equipment rather slow. Modern standards require concrete, or at least protected steel or mill construction with isolated storage bays holding not more than 15 or 20 cars each. The extreme hazard to the service of losing perhaps one hundred cars in a single fire is thus avoided.

Power and Distribution System

Power House and Power Supply. The United Railroads is now mainly supplied from the Sierra and San Francisco Power Company's hydro-electric transmission system, built within the last

three years. This system is controlled by the United Railways Investment Company. Under the terms of a 44-year contract the United Railroads has prior claim upon this Sierra power supply up to 28,600 kw. out of a total present plant capacity of 50,000 kw. The Power Company has first option to furnish any increased supply needed. For temporary fluctuations an increase of 10% above the maximum, and an additional increase of 10% for periods of not over 5 minutes, or 21% total, may be drawn upon without notice (provided this increase is within the capacity of the apparatus available).

In addition to this source, the United Railroads receives power from the steam turbine plant of the City Electric Company. This power was contracted for in 1907, and during the 10-year contract term the railways must absorb a fixed load of 4,000 kw. during 20 hours and 2,000 kw. for the remaining 4 hours of the day at a price of 1.1 cents per kw. h., which is relatively high for block operating power under conditions giving practically 92% load factor.

The Sierra Company holds in reserve as an emergency plant the North Beach steam turbine station, 18,000 kw. rated capacity, formerly the principal power plant of the United Railroads. Equipped with oil-fired water-tube boilers, this plant is capable of being started on very short notice—within 20 minutes—as steam is kept up continually.

The old Bryant Street station is the only steam plant now owned by the United Railroads, as all the other power properties have been disposed of (as far as the generating and transmission equipment is concerned) to the Sierra Power Company. During 1909 and 1910 the Bryant Street station was used daily for a few hours during peak load, but since that time it has been practically out of service. It can hardly be considered other than a last reserve, as the equipment is 15 years old and entirely obsolete. Its capacity is only 3,200 kw., with a possible maximum of 4,500 kw.

At the present time, the maximum power demand of the United Railroads system is from 25,000 to 28,000 kw. In case of complete breakdown of the Sierra power, the combined capacity of the City Electric, North Beach and Bryant Street stations would total about 35,000 kw., during peak load (assuming an overload capacity of 50% above rating for one to two hours at North Beach). Thus, for present power demand, both the original source and reserve capacity appear to be sufficient.

The necessity for the development of a new power system arose through the extreme shortage of power brought about by the electrification of the whole traction system at once. Had not the fire developed this crisis, the work would have been spread over a num-

ber of years, during which time adequate power supply could have been developed. It was therefore necessary for the railways to turn to other available sources, viz.: the Pacific Gas & Electric Company, and later the City Electric Company. And had sufficient power capacity been available even then, possibly an independent system would never have been needed.

But the records of power service from 1907 to the present time show that the supply was at that time inadequate, and uncertain. Between 1907 and 1910 the power interruptions averaged 17 per month, and frequently from 5 to 10 interruptions per day; these ranging from momentary to perhaps an hour's duration. A considerable part of these interruptions occurred during the rush hours. For the last two years, however, after the Sierra Company was able to take over the major portion of the load, the interruptions have averaged 5 per month—a reduction of about 70%. There is no doubt that much unmerited censure was directed at the United Railroads' service due to this unfortunate situation in regard to adequate power supply arising largely as a result of the fire, which made it impossible for the electric traction system to show to advantage in its early days.

Sub-Stations

Millbrae sub-station	1,000 kw.	2 motor generator sets
Bryant Street sub-station	9,000 kw.	6 motor generator sets
Turk Street sub-station	9,000 kw.	6 motor generator sets
Geneva Avenue sub-station	3,000 kw.	2 motor generator sets
Bay Shore sub-station	400 kw.	
	22,400 kw.	

The United Railroads operates five sub-stations of modern type and in first class condition, having 88 to 90% conversion efficiency from alternating to direct current. The normal daily D. C. peak load is about 23,000 kw., with an occasional maximum of 26,000 kw. Thus at present, the stations operate up to 15 to 20% overload, which is well within their capacity. But in case extensions are undertaken, and in any event before the Exposition in 1915, additional substation capacity will have to be provided.

Cable Power Stations. The three cable power stations at Washington and Mason Streets, Twenty-fourth and Castro Streets, and Pacific Avenue and Polk Street, are all operated normally by electric motor drive and adequate for present uses. In the first named station the original steam equipment is retained as an auxiliary to insure continuous service.

Overhead. Most of the overhead work is of good standard construction, using 5″-6″-7″ iron poles set in concrete. The trolley wire averages No. 2/0 B. & S. gauge, and is principally round wire, with soldered suspension ears. The lines seem liberally supplied with feeders, except on distant sections, as is apparent from the lighting of the cars during the rush hour.

Taken as a whole, the overhead construction may be considered of adequate design and in good condition. A considerable part of the feeder cable shows signs of worn insulation, but aside from that is in good shape.

Underground Conduit. The United Railroads owns underground conduit lines aggregating 162,759 duct feet, most of which is of the tile or fibre duct type. The streets covered are:

Market, from East to Twelfth..................	99,342	duct ft.
Mission, from New Montgomery to Ninth........	60,360	" "
Mason, from Post to Sutter....................	1,588	" "
Leavenworth, from Post to Sutter...............	1,469	" "
	162,759	" "

Of this conduit only that on Mason and Leavenworth Streets, totaling 3057 duct feet, is in use at the present time, the remaining 159,702 duct feet never having been utilized. These conduit lines on Market and Mission Streets should be put to use, so as to eliminate unsightly overhead feeders on some of the downtown streets. The copper replaced could then be used elsewhere on the overhead network, with practically full salvage.

CALIFORNIA STREET CABLE RAILWAY

The California Street Company operates two cable lines, the Jones and Hyde Streets and California Street, totaling 5.36 miles of double track or 10.72 miles of single track. All of the track has been relaid since January 1st, 1909, with 60 ℔ 3½″ grooved girder rail of special design, and at the present time is in excellent condition.

There are 36 special layouts in the California Street system, of which 19 have already been classified under "United Railroads property jointly operated." The remainder consist entirely of built-up layouts, and for the most part are in fair condition.

The Company owns 44 double-end, single-grip cable cars, of the "old California" type, which have been built since 1906, all of the old rolling stock having been destroyed at the time of the fire. All the equipment is in good condition, and a proper schedule of maintenance is in force.

The only car house owned by the Company, at California and Hyde Streets, was rebuilt following the fire of 1906, and is in fair condition, although hardly suitable for car storage purposes on account of the fire risk. The only fire protection provided consists of a few patent extinguishers and hose reels, and the track layout is such that it would be practically impossible to remove the cars quickly.

A repair shop is operated in connection with the car house, and is adequate to take care of any work which may come up in the ordinary course of operation, even to the extent of building or rebuilding cars, trucks and grips.

Power is furnished from a steam plant in the basement of the main building, and while old, the plant is in sufficiently good condition for present purposes.

PRESIDIO AND FERRIES RAILWAY

This company operates about 8.13 miles of single track, .3 miles of which is used jointly with the United Railroads.

The rail used is as follows:

107-109 ℔ 7″-9″ trilby rail	70%
81 ℔ 4″ trilby rail	13%
85 ℔ 9″ girder rail	11%
70 ℔ tee rail	6%
	100%

Most of the track is in good condition.

There are 23 special layouts on the lines of this company, of which half are used jointly with the United Railroads. All are of the hard center type, and in good condition.

All overhead construction is of the span type, using iron poles, and is uniformly in good condition.

The car equipment consists of 29 single truck cars, which were purchased from the United Railroads and are of the same type as its 600 class. While the rolling stock is kept in good condition by a proper schedule of inspection, maintenance and painting, the type and motor capacity is inadequate, especially for other than hill-top service as already reported in Chapter 9.

One car barn is owned by the company at Union and Gough Streets, which is just about sufficient to house the entire equipment, and provides ample facilities for inspection and for removal of cars in case of fire.

Direct current power is purchased from the United Railroads, the Company having no sub-station or power house equipment of its own.

Car Maintenance, United Railroads

As maintenance of equipment forms one of the most important elements of good service, the organization and general results are here dealt with in some detail. The five principal departments of car maintenance—machine shop, electrical repair, car wiring, overhauling, and car building—are now consolidated under one head, the master mechanic, at the Geneva Avenue shops. Here all general overhauling and heavy repairing is done, while inspection and light repairs are carried out at the various car barns, likewise under the direction of the master mechanic. Two car houses, Turk and Fillmore, and Twenty-fourth and Utah Streets, are equipped for such overhauling as necessitates removal of trucks and motors.

Daily inspection at car houses covers trucks, brakes, and brake rigging. Once a week, a complete inspection is made of all equipment, mechanical and electrical, the cars being held out of service in rotation for this purpose. Brake shoes are changed on general inspection day if worn so as not to last another week.

Each car is cleaned daily, including sweeping, dusting, and cleaning windows, and is washed inside and out once a week on its general inspection day. A vacuum cleaner is being used at the Geneva Avenue car house with effective results.

Every thirteen months, each car is completely overhauled, repaired and either repainted or revarnished as may be necessary.

Maintenance Record. Neglecting the temporary retrenchment of maintenance in 1908 shown by the graphical record, Fig. 98 it appears that since that time a general rehabilitation of the rolling stock has taken place. An inspection also shows that the important equipment has been put in good condition for service. The effectiveness of the work is shown by a decrease in the actual cost of car maintenance, and at the same time an increase in mileage. This decrease in maintenance has amounted to 40% in two years, with an increase of 10% in car mileage, which is equivalent to a saving of over 50%.

Car painting was deferred from 1907 to the summer of 1909. During 1910, the cars were being repainted at a rate of 35 per month, and as a result of this schedule, 81% of the total

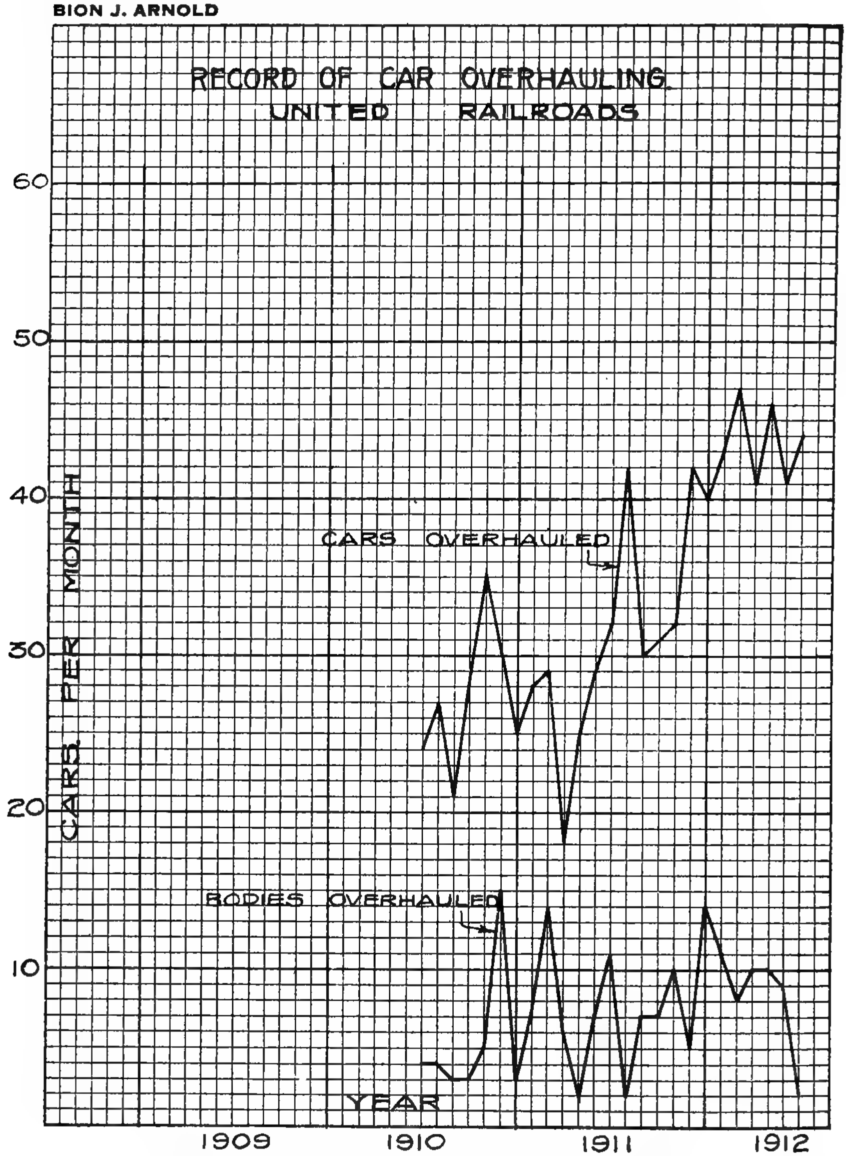

FIGURE 96—MONTHLY RECORD OF CAR OVERHAULING.

These curves are of general interest in that they show the relative condition in which the rolling stock of the United Railroads is being maintained. The monthly record of work done at the Geneva shops shows a steady increase in car overhauling of nearly 50% within the last two years—corresponding to a change from about a 24 to a 13-month overhauling schedule. The present frequency of complete overhauling is ample to maintain the equipment in good condition.

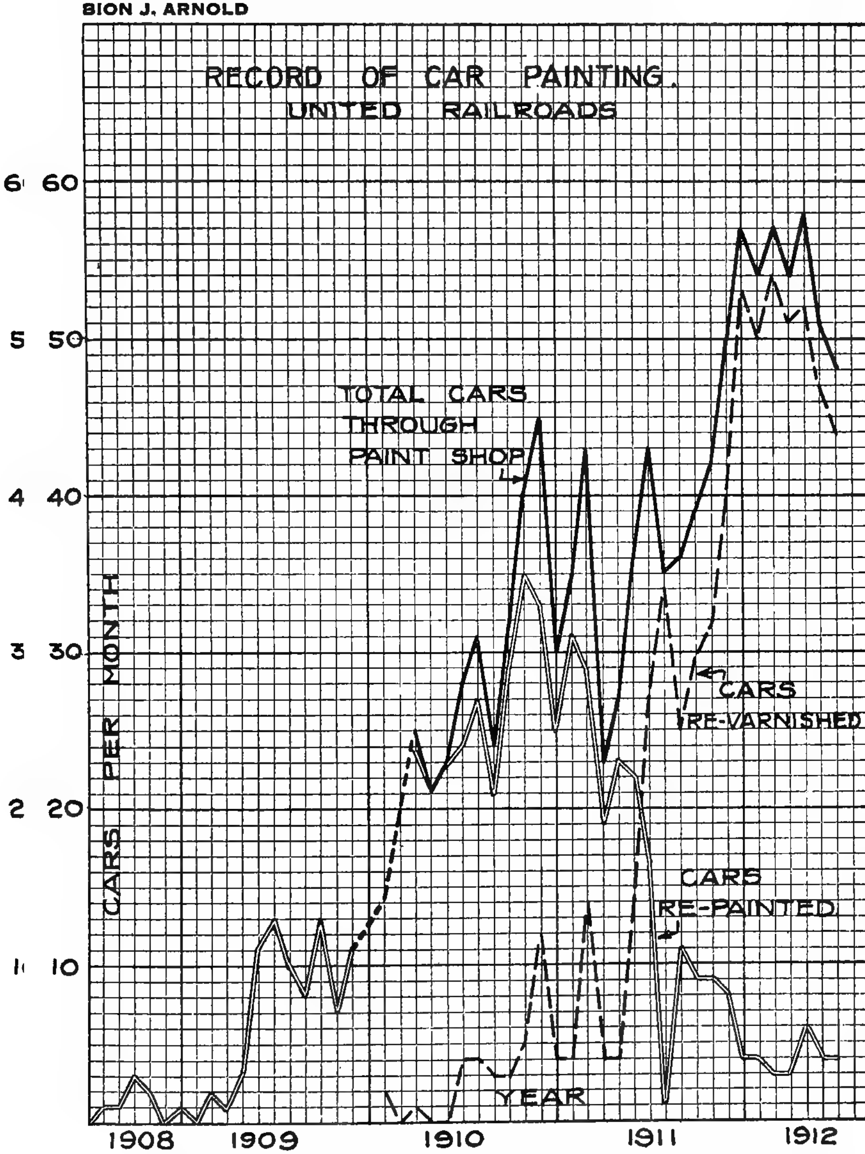

FIGURE 97—RECORD OF CAR PAINTING AND VARNISHING.

Giving an idea of the relative amount of attention paid to the appearance of rolling stock. The curves show a very rapid increase in the cars repainted per month up to 1910 and since that time a rapid decrease, but within the two-year period 500 cars, practically all of the old equipment, were repainted. Since 1910, the number of cars revarnished per month has shown a steady increase until now practically all of the cars run through the paint shop are revarnished only. The 12-month schedule of cars passed through the paint shop now in force will be ample if continued, and indicates very good maintenance.

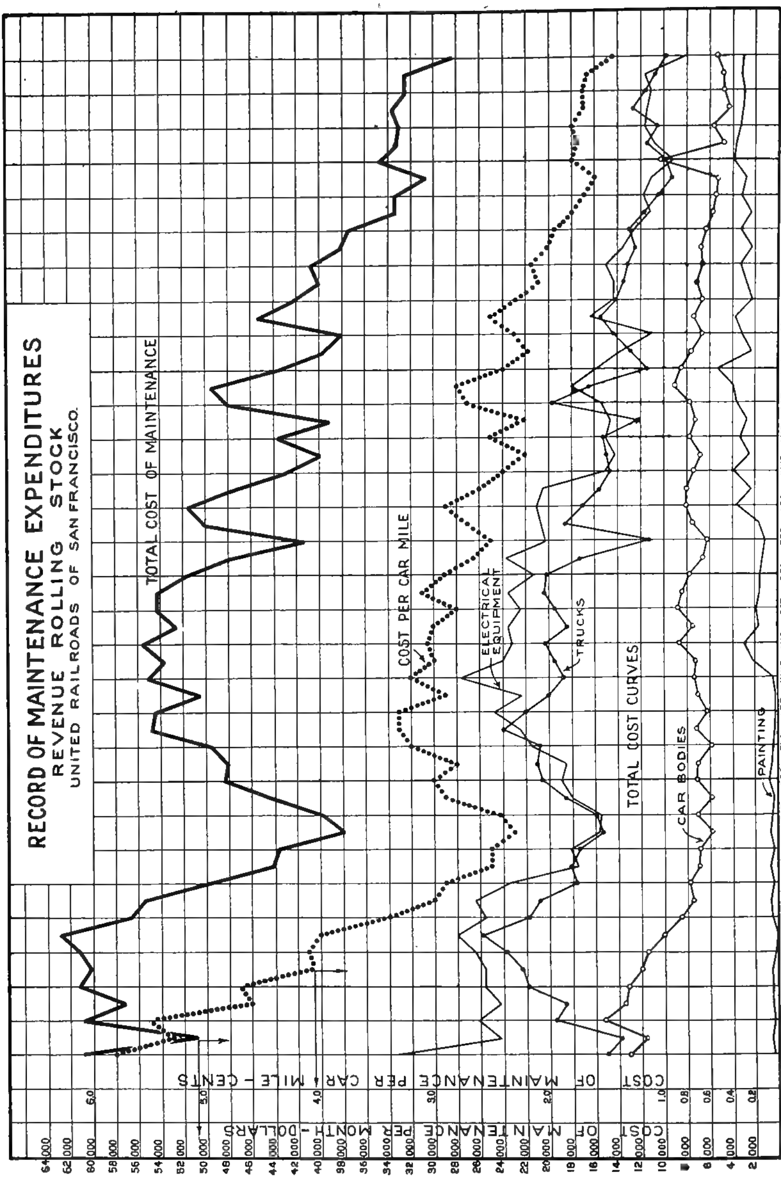

FIGURE 98—RECORD OF CAR MAINTENANCE EXPENDITURES.

In fixing upon a reasonable maintenance standard in a resettlement plan, it has been necessary to determine the effectiveness of past maintenance work and its relation to earnings. These curves show that succeeding the abnormal condition following the fire and strike, the expenditures for car maintenance in all its branches with the single exception of painting have been increased by 10%, resulting in a drop of over 50% in maintenance cost per car mile. While this record alone might indicate a general curtailment in maintenance, reference to other records of the actual amount of work done, however, indicates an improved standard. In fact, since 1909, the effectiveness of car maintenance work has greatly increased, resulting in a lower actual cost and better conditions than formerly.

equipment was gone over. The record, Fig. 97, of cars passing through the paint shop indicates that the equipment is undergoing effective maintenance. The overhauling record, Fig. 96, also indicates increasing maintenance—nearly doubled since 1910, due to a reduction of the overhauling schedule from 21 months in 1910 to 13 months in 1912.

Electrical equipment maintenance record shows improved operating conditions by consistent decrease in armature removals per car mile—12% in two years. During this time the cost has decreased 30%.

Probably the best index of maintenance is in the number of pull-ins, or conversely, the number of cars in operation. On this system, car miles per pull-in increased from about 2,000 for March, 1910, to 3,500 in July, 1912, an increase of 75%. By actual inspection on July 15, 1912, 92% of the equipment was found to be in service during the rush hour. Of the balance —8%—one-third was in the shops for repairs. This good record has, of course, no bearing on the adequacy of the equipment, but rather indicates the policy of the Company in the matter of car maintenance.

PART VI

FRANCHISE AND LEGAL MATTERS

CHAPTER 16

CHARTER AMENDMENT No. 34 *

Discussion of Underlying Principles

In Chapter 1, dealing with Present Transportation Conditions, there were reviewed very briefly some of the essential matters relating to franchises and regulations that must be given serious attention before it will be possible to reach any satisfactory permanent settlement of the various questions involved in transportation service of San Francisco. This review also emphasized the uncertain status of the railway corporation with regard to its franchises, the retarding effect of the present city Charter provisions on further investment of private capital, and the possibility of a contract-franchise plan involving municipal regulation and profit-sharing by which the perplexing problems of the past and future might be merged into that of the present solution. This chapter presents for consideration the basic principles of Charter Amendment No. 34 submitted to referendum vote on December 10th, 1912. The full text of this Amendment will be found in the Appendix hereto.

There are two distinctly different situations which call for solution in the present Charter revision.

1st. The outlining of future conditions pertaining only to *new franchises* granted subsequent to the passing of the amendments either as

(a) Trunk line franchises, or

(b) Extension franchises.

2d. The establishment of conditions which will make possible effective operation under *existing franchises* and at the same time secure the *necessary expansion of the present system* by private capital *until such time* as the City is able and desires to take over the entire properties as a municipal project.

It is evident from a study of the proposed Charter revision amendments that no provision has been made for this latter and most important condition, for, if the proposed amendments were passed, any contract-franchise plan that might be developed and that did not conform to the provisions of the new amendment, however just and feasible the plan might be for the *present* situation, would be illegal and impossible to carry out until further enabling amendments were adopted. It therefore seems desirable, if these amendments are to be adopted now, that a section be incorporated in the revised Charter, dealing specifically with a

*Formerly Preliminary Report No. 13, submitted Nov. 5, 1912.

possible contract-fanchise settlement of existing questions, or else that definite provision be made by means of some form of exemption clause whereby such a settlement plan may be evolved *at any time* and put into effect independent of the Charter provisions dealing with new franchises.

There will follow a detailed analysis of the essential elements of a practicable franchise policy for both present and future wherein are involved the purchasing power of the City, the earning power of present franchises, the legal questions regarding their validity, the respective rights and view-points of the City, the Corporation, and of Labor.

Taking into consideration the available facts discussed herein and drawing upon the experience of other cities in their effort to find a practicable solution of their transportation difficulties, I interpret the present traction situation in San Francisco, as follows:

CONCLUSIONS FROM PRESENT CONDITIONS

1st. The City of San Francisco has created, through the high riding habits of its citizens, an exceedingly profitable traction field from which it should be possible with reasonable capital investment to derive, within the limitations of a 5-cent fare, a high standard of service, as compared with other cities. This condition of service does not take into consideration the results of such catastrophes as have occurred within recent years to curtail the possibilities of the system.

2d. The powers of regulation over public utilities vested in the municipalities of California are exceedingly broad as compared with those of the older cities of the East, and comprehending supervisory power over rates, service, equipment and capitalization, the reasonable exercise of these powers should place the City in a most fortunate position with respect to utility properties organized after these powers had been confirmed. But before these powers were established, conditions were less fortunate from the City's standpoint, as a result of rights granted.

3rd. The railway corporation is in unquestionable possession of the best-paying city streets for a long term of years, during which time it will be able to earn out of the property nearly three times its present liberal capitalization, provided of course that in the meantime it renders adequate service over its lines now established.

4th. Being in possession of the short-haul and most profitable lines, it will be in a better and better position as time goes on to earn large returns, for the reason that the City has *no power*

to compel extensions; consequently, the poor-paying extensions will either have to be borne by the municipal system, or else the development of the city grossly retarded.

5th. It is a fact that, even if the franchises of a large portion of the city expired at a given time, the pressure of public necessity would absolutely require the corporation to continue service over the unexpired lines until such time as the City was in a position to operate them under a satisfactory system of routing, so that the earning power of the remaining fragments of the system would continue for some time.

Since there is nothing in the present franchises requiring the maintenance of the system at a higher standard than that necessary to give actual operation, it is quite probable that a general rehabilitation of the system would be necessary, requiring perhaps two years, before the City, even though it had possession, would be in a position to operate the new system efficiently.

6th. Owing to the fact that the City has embarked upon a fixed policy of municipal ownership and possibly competition, the Corporation does not feel justified in making any extensions, and in fact cannot obtain funds therefor from private investors at reasonable prices. The City therefore must face a situation where the Corporation will continue to reap heavier and heavier profits from its short-haul lines, without making the necessary extensions. The effect which this policy has had upon the development of the city is already only too apparent and it is pertinent to reflect what the condition would be seventeen years hence, if this policy were to be continued.

7th. At the present time the purchasing power of the City approximates only $50,000,000 for all utility purposes, and if water bonds are excluded from the debt limit, this purchasing power could be exercised for the acquisition of street railway property. These funds, while more than sufficient to acquire the actual physical property, would probably fall short of what the present railway companies would consider reasonable, including franchise values under the contractual relations embodied in the present franchises.

Moreover, it has been shown that the purchasing power of the City, now entirely pre-empted for other enterprises, will require an increase of at least one-third in the bonding limit for railways alone. And unless such a progressive increase is made, the purchasing power will become more and more inadequate as time goes on and expensive rapid transit projects develop.

8th. Financial credit is in most cases a function of stability of property and efficiency of management. Therefore, the question whether the City can underwrite its utilities at a lower rate

of interest than private capital will accept depends upon these two considerations. And the City must not lose sight of the effect that a wholesale expansion of its municipal undertakings would have upon its credit, and especially with reference to the securities previously issued.

9th. The Corporation, on the other hand, is beginning to experience, for the first time in its history, the pressure of regulation and supervision, both from the Municipality and the State, and owing to a loss in earnings of approximately $5,000,000 from the fire and strike, it finds itself in a financial position not contemplated at the time of its organization. Not having elected to provide for such a contingency, it is difficult for it to absorb these losses under the heavy burden of fixed charges and the pressure for dividends.

10th. The present condition of the property, in spite of the heavy renewals and betterments that have already taken place since the fire, is such as to require *a continued program of rehabilitation,* necessarily involving heavy expenditures, only a portion of which may be capitalized as betterments and additions. The nature of these renewals is such that to capitalize them *in toto* would be a duplication of capital unwarranted in modern systems of accounting. The Corporation, therefore, must find itself confronted with the necessity of retiring this extinguished value out of earnings which will necessarily cut deeply into the contemplated return.

11th. The attitude of Labor, while at present passive, may become serious from time to time in the future as it has in the past, although not now apparently imminent, as railway wages in San Francisco are somewhat higher than in other parts of the country, being exceeded in but one instance by a Coast city. However, the determination of a proper wage scale is an ever-recurring problem and with the present tendency toward increasing prices, it seems but a question of time when the wage question, in addition to those of financing, franchises, and regulation, will combine to render increasingly difficult the operation of the Corporation upon its present basis of capitalization.

12th. The Charter wage scale now in force, as applicable to private corporations, will be shown later to be a practical impossibility with a 5-cent fare under any normal conception of adequate service or reasonable operating ratio. In street railway operation more than in any other public utility, the time limit for working hours and the high minimum wage imposed by the Charter, work exactly opposite to the provision of adequate rush hour service. The adoption of this wage scale would prevent the Corporation from earning a reasonable return upon its present bonded debt, to say nothing of attempting to earn a return upon its present cap-

italization. Even if a reasonable return upon the value of the physical property only were under consideration, the operating ratio under this Charter wage scale would be higher than justifiable under a 5-cent fare, if adequate service is demanded from the Company.

The wage question should be settled from time to time as new conditions arise, with due consideration for the financial and industrial conditions of the community, and it therefore is, in my judgment, an economic error to legislate wages into a Charter.

13th. An analysis of the possibilities of the retirement of invested capital during various periods of maturity and at various rates of interest shows that it is practically impossible to retire out of earnings street railway investments within so short a period as 25 years—the limit of franchise term under the present Charter—and earn a fair return upon such investment. This arises from the fact that the necessary investment in property is three or four times the annual earnings, so that the annuity rate for a term of 25 years may be as high as 11% of the gross earnings, which represents a much larger proportion of the gross earnings than can possibly be appropriated for the retirement of the investment under a 5-cent fare. Consequently, the proposed Charter should be changed so as to either materially lengthen the franchise term, provide for an indeterminate franchise, or make provision for protecting the investment in the property after the expiration of a determinate franchise until such investment can be amortized out of the earnings at a reasonable annual rate. This can be effectively accomplished by the issuance of long-term bonds by the Corporation with the City's consent, and with definite provision for the assumption of this underlying debt by the City at the end of the franchise term.

14th. In perfecting a franchise plan for the present as well as the future, it is most important to appreciate the seriousness of and to provide for the amortization or decapitalization of that part of the original and subsequent investment, which is not now represented by actual tangible property, but which expenditure nevertheless was incurred in order to create the properties as they at present exist; also the additional capital liability with which the properties were burdened over and above the necessary expenditures just mentioned.

Obviously, there are only two plans upon which a property may be organized:

First, when it is operated to extinction at the end of an existing franchise term;

Second, when it is operated as a continuing property in anticipation of renewed grant, or sale to the City.

If operated to extinction, it is evidently incumbent upon the Company to retire all of its capital liability, both tangible and intangible; but if the property is to be continued as will unquestionably be the case, it is economically unnecessary to burden the community with the necessity of creating a property free of debt within the short life of ordinary franchises. Therefore, the first duty of the Corporation should be to decrease its capital account by amortizing out of its earnings all of this so-called intangible value.

Summarizing, it is my desire to convey from the above the firm conviction now in my mind, reached only after detailed consideration of these various questions, *that the present problem is by no means one-sided;* that the three factors in the problem—City, Corporation and Labor—are equally involved; and that any settlement of these difficulties that is destined to achieve permanent and satisfactory results must be in the nature of an attempt to secure definite, practicable, working results, rather than to strive for the perpetuation of individual rights, all of which are more or less questionable. The great objects are:

I. Adequate service;
II. The protection of actual investment, whether municipal or corporate; and
III. The highest rate of wages consistent with the limitations of a 5-cent fare, and the proper maintenance and renewal of the property.

Supplementary to these are:

(a) The method of regulating the utility.
(b) The method of decapitalizing obsolete investment and intangible values.
(c) The determining of the question of whether the investment shall be a continuing one or be decapitalized to extinction; and if the latter, the fixing of the period long enough to make it practicable under a 5-cent fare.

The proper vehicle for the accomplishment of these objects is the modification of the present Charter by suitable enabling amendments which will empower the Board of Supervisors to work out and submit to a referendum vote suitable adjustment franchises which will eliminate present contractual relationships and place the City in position to substitute others therefor which will secure the three objects above enumerated.*

* Upon the submission of the preceding summarization, the Board of Supervisors decided, after discussion, to proceed upon the theory of submitting to the electors a broad enabling act instead of a detailed franchise code, and appointed to draft such an act a special committee consisting of Delos F. Wilcox, Chief of the Franchise Bureau. Public Service Commission, New York City; E. A. Walcott, President of the Civil Service Commission, City of San Francisco, and Bion J. Arnold. This committee reported November 7th, 1912, and the amendments, after thorough discussion by the Supervisors and others, were with slight modifications, unanimously adopted on the same date.

In the complete amendments as finally adopted, were included the following supplementary amendments:

Article XII, Chapter I, "Acquisition of Public Utilities," being Sections 1 to 16, inclusive, of Article XII of the present Charter.

Article XII, Chapter II, Sections 1 and 2, inclusive, "Construction of Public Utilities."

Article XII, Chapter III, Sections 1 to 5, inclusive, relating to the "Department of Public Service" and creating a Public Service Commission for the City and County of San Francisco.

These supplementary amendments, Chapters II and III, as finally passed by the Board of Supervisors, contained most of the important revisions that, to me, seemed necessary from a study of the amendments as originally drafted.

SUPPLEMENTAL DISCUSSION

The Present Charter, which went into effect in 1907, in its general terms was designed to empower the Board of Supervisors with broad regulative powers and control over public utilities operating within the City and County of San Francisco. Apparently, none of these powers, as outlined therein, are retroactive—that is, they do not apply to franchises granted prior to 1907 unless specific provisions in the franchises anticipated such future revision as actually took place.

The Board of Supervisors has power to determine rates and prescribe service, wages and hours of labor, and to examine books and records, or cause to be made through arbitration proceedings valuations of property which the City desires to purchase. The Charter declares for municipal ownership of utilities with power to take over traction properties at a fair value, including bonus, but excluding franchise value. The franchise term is limited to 25 years and awarded to the highest bidder upon the basis of percentage of gross receipts. Conditions surrounding construction and operation of utilities are specified, failure to comply with them working immediate forfeiture of the franchises, which the Board of Supervisors has no power to relieve. Roadbed and fixtures become the property of the City at the expiraton of the franchise term.

Having declared for ultimate municipal ownership, the Board of Supervisors is empowered to buy or construct utilities when public necessity demands; but the City's bonded debt is limited to 15% of the assessed realty value with a maximum limit of 75 years' life of bond issues, redemption to be commenced within 18 years.

A minimum wage scale of $3.00 for an eight-hour day to be completed within ten hours, with a one and one-half time rate for over-time, is specified to apply to all new franchises granted to privately owned street railway companies, but the same conditions are not specified for those employed in municipal enterprises. The Charter, instead of making this condition imperative upon

the City, exempts it from the time limit of ten hours in which the eight-hour service must be performed, and also the compulsory payment of a one and one-half time rate for over-time.*

Proposed Charter Amendments. In order to facilitate the fullest understanding of the principles and purposes underlying the construction of this proposed Charter Amendment No. 34, the following discussions of the underlying principles are appended. Briefly expressed, the purposes of the amendment are:

1st. To provide in the Charter a "blanket" enabling act, outlining the general terms under which detailed municipal ordinances may later be prepared by the Board of Supervisors, subject to the referendum vote.

2d. To establish the foundation for a comprehensive franchise or administrative code, defining in specific terms the conditions and limitations under which all new franchises may be granted by the City to private operators.

3d. To empower the Board of Supervisors to carry out a comprehensive resettlement or adjustment franchise policy by means of which existing grants to private operators may be merged into those of new or adjusted grants containing specific conditions calculated to remove the present obstacles to adequate service and continued expansion.

It has been deemed essential in the preparation of these amendments that detailed matters relating to the granting of franchises be incorporated in such a comprehensive franchise code, rather than in the City Charter; that, on the other hand, a City Charter should constitute a simple declaration of principles only, by reason of the wide variation in the conditions surrounding the granting of franchises to different utilities which will necessarily change from time to time. The Charter amendments are designed to cover all manner of utilities which, in the expressed determination of the City, fall within the scope of its operations. The franchise code, on the other hand, should cover separately each of the various utilities to be encountered where variations from the general principles therein expressed need to be specified.

*This discrimination falls particularly heavy upon a street railway company, owing to the fact that its two periods of daily maximum or rush hour service (each two or three hours long) come so far apart that men employed for one of these periods cannot be employed for the other period without the payment of overtime; otherwise the employment of additional men is necessary, thus resulting in the payment of a proportionately large amount of wages for which no service has been rendered. It would seem, therefore, that street railway employees, owing to these unavoidable conditions of the business in which they are engaged, should be willing to extend the total period during which their services are rendered, provided they are paid a suitable wage per hour with a reasonably minimum wage, especially since the total time of actual service is reasonably short, and since they are free to attend to their own affairs during the interval between rush hour periods. As such short runs are usually and properly assigned to students or apprentices in the business, and the full-time, regular runs are reserved for the more experienced men, a reasonable disposition of the wage question along these lines should be accomplished, and by this means secure adequate service under a 5-cent fare.

In order to carry out the provisions of franchises hereafter to be granted under ordinances passed by the Board of Supervisors in accordance with the terms of the Charter amendments, there is created in other Charter amendments to Article XII, Chapters II and III, a Public Service Commission for the City and County of San Francisco, consisting of three members appointed by the Mayor, each for a term of six years, except those first appointed, whose terms end July 1, 1915, July 1, 1917, July 1, 1919, respectively. This Commission is to have charge of the construction, extension and operation of all municipally owned and operated public utilities, the harbor and water-front and all works located thereon for the use of commerce. This Commission will also exercise control over such other public utilities as the Board of Supervisors may from time to time prescribe, but which are not covered by this Charter. It is also authorized to enter into contracts for construction or for materials necessary for the construction or operation of such utilities, as well as to exercise all other powers over public utilities elsewhere conferred by the present Charter on the Board of Public Works.

Letter of Transmittal—Amendment 34

To the Honorable,
The Board of Supervisors of the
City and County of San Francisco.

Gentlemen:

In accordance with your instructions, we have prepared a draft of Charter Amendment No. 34, relative to the granting of franchises upon which we have been able substantially to agree. Such amendment is submitted herewith with our recommendation that it be adopted for submission to the people at the Special Election on December 10th, 1912. In this amendment we have attempted to cover in general terms the entire subject of the granting of franchises leaving to a general ordinance to be enacted later by the Board of Supervisors and ratified by the people the more detailed procedure which may be regarded as essential to protect the City's interests in the granting of franchises in the future. The amendment presented contains, we believe, all or practically all the essential features of a general franchise policy, in accordance with which the City should be able to work out satisfactory practical results.

Respectfully submitted,

(Signed) DELOS F. WILCOX, E. A. WALCOTT,
BION J. ARNOLD.

Submitted November 7th, 1912.

Synopsis, by Delos F. Wilcox, of Charter Amendments Relating to various Public Utility Franchises Drafted by the Special Committee Appointed by the Board of Supervisors.

The Board of Supervisors has no authority to grant franchises for any public utility except in accordance with the provisions of the Charter.

The outstanding street railroad franchises make no provision for extensions into outlying territory.

The outstanding gas, electric and water franchises, acquired under the Constitution of 1879, cover only such streets and parts of streets as were actually occupied with mains prior to the adoption of the Constitutional Amendments on October 10th, 1911.

Consequently, no extensions of street railroads, gas or water pipes, or electric lines can be made under existing franchises, even if the companies are willing to make them. In every case, new franchises are required.

The provisions of the existing Charter relative to the grant of franchises have proved to be impractical, as they tend to penalize the companies for doing what the City wants them to do, namely, extend their lines. For a company to accept a franchise for an extension, under the present Charter, the extension would have to be unusually profitable taken by itself, while in most cases where the extensions would have to be carried by the profits earned on the main lines or in the areas of dense service, there is nothing whatever to induce the companies to build and the City has no power under existing franchises to make them build.

This situation has long been critical in regard to street railways, and, under the recent decision of the Supreme Court in the Russell case, will soon become equally critical as to water, gas and electric service.

These conditions made necessary the proposed amendment to the Charter relative to franchises. If this amendment is defeated there will not be another opportunity to amend the present Charter until two years hence.

The proposed franchise amendment is based upon the City's declared policy of ultimate municipal ownership. Not only do all franchises require a three-fourths vote of the Board of Supervisors, but in case they are vetoed by the Mayor, they can be repassed only by a five-sixths vote. Moreover, the Mayor can, if he wishes, insist upon a referendum, and every grant of a new franchise to renew

or replace an existing one must be submitted to the people. Entirely new grants and grants for extensions are subject to the sixty-day optional referendum procedure for due publicity, and time for deliberate consideration is carefully provided for. The right of the City to take over the franchise and property at any time is expressly stipulated, and in order that this power of purchase may be something more than mere power on paper, it is required that provision shall be made in the franchise itself for the accumulation of a purchase fund out of earnings, so that the property will actually be paying for itself, and the City will be getting into a better position in regard to it every year.

On the other hand, under the proposed franchise plan, the actual investment of capital in any utility enterprise would be amply protected and would be allowed to earn a fair return and be sure of not losing out in the end. The requirement in the present Charter that a fixed percentage of gross receipts mentioned in the Charter itself must be paid whether the utility or the extension is able to pay even operating expenses or not has been cut out.

The existing provision that the property in the streets shall revert to the City without payment at the expiration of twenty-five years and forbidding a re-grant beyond that time is also eliminated, and in place of it is put a more elastic provision to the effect that part or all of the capital must be retired within the twenty-five year maximum period for original grants, but that if the capital has not all been retired within that time and if the City does not choose to buy the property, the holder of the franchise shall be entitled to fifteen years more to get his money out.

The existing minimum wage provision as applied to franchises is eliminated from the Charter for the reason that it seems better to leave the whole matter of wages to be negotiated in connection with each particular franchise or between the employees and the owners of the utility.

It makes the Charter conditions less forbidding to capital, and does not prevent the establishment of a minimum wage in the franchise itself if it can be agreed upon at the time. The eight-hour day is kept, but the provision is liberalized with reference to street railways so as to make the eight-hour day actually workable under the conditions of that business, which requires the employment of a great many extra men for the rush hours, morning and night, if the people are to have reasonable service. As stipulated in the proposed amendment, the eight hours' work of the operating force of a street railway must be completed within thirteen hours, while in all other utilities the eight hours' work

must be completed within ten hours. This change removes a barrier that now practically prohibits the enlistment of capital in street railway building.

The existing prohibition of all exclusive franchises for pipes, wires or conduits, which was based on the constitutional provision in force prior to 1911, has been liberalized so that exclusive franchises may be granted which would tend to induce private capital to enter outlying fields. But the interests of the City are safeguarded by requiring that any such franchise must be subject to purchase and must provide for extensions of the plant as the public needs require.

Moreover, under the amendment, the Board of Supervisors does not need to wait for anybody to apply for a franchise for an extension or for a new utility, but may on its own motion declare the necessity for the construction of such extension or new utility, and advertise for bids. The City may advertise in all the financial centers of the world, if necessary, calling attention to the opportunity for investment.

But, after all, the most important provisions of this amendment relate to a possible resettlement of the franchises of existing utilities to the end that in return for the practical guarantee of their fixed investment and the new money put in from time to time, they shall surrender their outstanding franchises and come in under a new deal by the terms of which the City will get the right peaceably to acquire the property by paying a fixed price therefor, and the companies will obligate themselves in the meantime to make extensions and begin to retire their capital out of earnings.

As an extra safeguard, the City may provide for the transfer of the property to a new company, if, through persistent failure of the old company to co-operate in good faith in carrying out the spirit of the agreement, it seems useless to expect good results from the management then in control, and if the City is not then in a position to take the utility over for municipal operation. At the same time, the Company will be protected against capricious or corrupt action on the part of the City authorities by the requirement that any new company may be required under the terms of the franchise to pay a bonus to the owner of the property in addition to what the City would have to pay if the property were being taken over for public ownership.

This licensee provision is not made obligatory, but may be inserted in a resettlement franchise if the City desires to put it

in. In fact, the amendment is in effect an enabling act under which the City would be able to open up the whole franchise question with the companies and in accordance with certain general principles fixed in the amendment, negotiate for a rational resettlement of the big utility problems now confronting San Francisco.

As to grants of new franchises that are not resettlements of existing franchises, they are to be regulated more in detail by a general ordinance to be adopted by the Board of Supervisors and ratified by the people subsequent to the adoption of the Charter amendment and its final enactment by the Legislature.

CHAPTER 17

GENERAL FRANCHISE ORDINANCE

Analysis of Essential Requirements

Charter Amendment No. 34, as an enabling act, contemplated that individual franchises should conform to a general franchise ordinance drawn under its provisions. In the following topical abstract are presented and later discussed some essential requirements which, in my judgment, should be incorporated in such ordinances. These provisions were all considered in detail, both as to their present and future operation, before Amendment No. 34 was drafted into its final form, but could only receive the briefest mention therein. The major subjects involved are: Extensions, early losses, franchise term, decapitalization, sinking fund reserve, valuation, purchase clause, profit sharing, wage scales and regulative control.

RECOMMENDATIONS

General Premises. Ultimate municipal ownership, but unified operation with a uniform fare and universal transfers. Gradual acquisition and ultimate recapture of complete property assisted by decapitalization. Underlying property considered as a continuing investment. Municipal control of service, equipment, operation and audit. Profit-sharing plan with compulsory extensions proportionate to earnings.

Supplemental Charter Amendments

1. Unified Public Service Commission with representation for each utility in a voting board, unrestricted by local political influence. Balance of power to be vested in Chairman-Arbitrator, experienced in the administration of utilities. Engineering representation essential. Commission to exercise executive functions of the city government in utility matters, subject in its orders and decisions to review only by the State Railroad Commission and in turn by the Courts; to determine standards of service, construction, and accounting, with supervisions thereof; to determine the necessity and reasonableness of extensions; to certify to all questionable matters relating to franchises requiring legislative action by the Supervisors; and to constitute a guardian of the City's rights in the administration and regulation of its utilities.

2. Expansion of the City's purchasing power for the progressive absorption of utilities. Art. XII, Sec. 14, of the present Charter,

establishes the City's policy, which needs to be broadened by exempting from the present debt limit revenue-producing utilities and by permitting construction on the district assessment plan. Limiting the discount on City utility bonds rather than fixing the minimum selling price at par will facilitate prompt financing.

New or Original Franchises

1. Indeterminate form of franchise with continuing option for recapture by City by assuming underlying debts not exceeding depreciated value of physical property at date of purchase; surrender of present determinate franchises obligates the City to regrant on the indeterminate plan under agreed conditions specified therein.

2. City bonds to be acceptable to Company for part or entire payment, secured by the general credit of the City or by the earnings on the property.

3. Adherence to the present length of franchise term—25 years; extension to a maximum total period of 40 years permissible in the event franchise is not recalled by the City purchasing or finding a purchaser for the property.

4. Utility bonds covering underlying debt to be permitted to mature between these two periods under guaranteed assumption of underlying debt by the City at any prior purchase.†

5. Corporation to fully decapitalize out of earnings during its franchise term all elements of intangible value, depreciated or otherwise permanently extinguished, and a proportion (increasing with the length of the term) of the tangible value.

6. Recapture proceedings to include an arbitrated valuation of property, or else an agreed value; the chief arbitrator in case of disagreement to be selected by the State Railroad Commission, or finally by the Supreme Court.

7. Purchase price at any time to include "present value" of property and plant (including such intangible elements as interest during construction, early losses, brokerage or bond discount and a graduated purchase bonus) minus values retired by sinking fund or accruals thereto; indeterminate franchises disregard franchise value, good will, going value, etc.

8. If City exercises its option to purchase during franchise term, Company to receive a bonus decreasing from a maximum of 20% above the cost of producing the property new as governed by the terms of the franchise by equal yearly steps to zero at expira-

† Bonded investment might be limited to not over 75% of the reproduction value of the property new, balance to be made up by issues of preferred stock, carrying a sufficiently high return rate to bring the price near par; subsequent issues to cover possible extensions to be financed on the same basis or else the difference between bonds and total cost to be made up out of earnings from time to time.

tion, less the amount accumulated in the amortization fund to date of purchase, at which date the City will also receive, without cost, the amount then accumulated in the renewal fund, care being taken by the City at the time of granting the ordinance to see that suitable maintenance and renewal funds are established sufficient to maintain and keep the property in first-class condition. The initial bonus to be increased to 25% and similarly decreased if the property is re-sold or leased to private owners or operators.

9. Sinking funds to be in the hands of a qualified trustee and invested by him in Company bonds at market price when below par (when above par, subject to call at stated premiums) or in other safe investments.

10. Extensions, their necessity and reasonableness, to be determined and certified to by the Commission when the operation of such extensions would fall within the limit of a reasonable return on the entire investment.

11. Rental value of extensions built by the City to be determined by the Commission, such extensions to be maintained by the operator.

12. Appraised value of equipment provided by the Company (cars, overhead and underground transmission) to be assumed by the City as part of an extension acquired, provided that it be adequate for the service and in good operating condition.

13. Short extension and connecting franchises to be granted upon certification by the Commission without referendum.

14. All extension franchises to expire simultaneously with connecting franchises; conditions and obligations of extension franchises to conform in general with those of connecting lines, except where specifically exempted.

15. Validity of franchise grants to be contingent upon the completion of construction work contemplated thereunder within three years (or less in some cases) and with continuous operation thereafter under conditions specified.

16. Modification of obsolete conditions and unreasonable obligations imposed in original grants, or exemptions from percentage franchise taxes or other conditions in the case of non-paying extensions, to be permitted when necessary at the discretion of the Commission.

17. Income from extensions to be assumed as that proportion of the total earnings of the route connecting therewith which the car mileage over the extension bears to the total car mileage of such connecting route; this mileage to be determined from official schedules filed with the Commission. Operating expenses to be averaged over the entire mileage of the system.

18. Fixed conditions, such as income distribution, *except the divisions to City, Company and Labor as fixed in the ordinance,* reserves, type of motive power, routing, headway, and other variables to be readjusted from time to time with the consent of the Supervisors upon proper verification of the necessity therefor by the Commission.

19. Distribution of income to be applied in the following order: (1) direct cperating expenses* and taxes; (2) reserve for renewals to cover permanent shrinkage due to normal wear, depreciation, obsolescence, inadequacy, etc.; (3) reasonable interest return on investment (or in the case of resettlement franchises, a basic return on "agreed capital value"); (4) amortization fund for decapitalization of intangible and tangible investment; (5) contingent reserve fund for providing for lean years and other emergencies;† (6) balance or residual net to be shared by Company and possibly by City, with some provision for employees' bonus, pension and disability fund.

20. In order to avoid delays and brokerage, and upon authorization by the Commission, cash reserve funds for renewals or amortization (but not accident fund) may be used temporarily to meet unexpected, unavoidable or extraordinary demands for money necessary to place the railway property in operating condition as it existed prior to any accident caused by earthquake, fire or other acts of God, and provided further that the Commission shall, at the time such loans are made, see that ample security is provided for the safe return to the amortization fund of all the money so borrowed from said fund, and to the renewal fund the amount expended out of said fund in excess of the actual accrued depreciation (to the date of the accident) of the property destroyed. The difference between the original cost of the property destroyed and the accrued depreciation (to the date of the accident) plus salvage shall be taken from the contingent reserve fund (5) defined in the next preceding paragraph of this chapter, and in case said fund (5) is not sufficient to meet the loss, the difference between said loss and the amount in said fund (5) shall be taken from amortization fund (4) described in the same paragraph.

21. No franchises or property acquired thereunder to be sold, leased, or otherwise disposed of without the City's consent, and recommendation by the Commission.

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*Including maintenance and insurance but excluding taxes and depreciation.

†This fund should be accumulated monthly by appropriating a comparatively small percentage of the gross receipts, and when it reaches a certain maximum amount as agreed in the franchise, all additions to it thereafter above this amount can then be used at the discretion of the Board of Control for any or all of the following purposes: (a) to improve service, (b) to reduce capitalization, (c) to reduce fares, or (d) to be divided between City and Company upon an agreed basis.

22. Forfeiture of franchise to be the penalty for substantial failure or refusal to comply with conditions therein not due to causes beyond the Company's control; this penalty to involve recapture of both franchise and property by the City without cost, subject to court decision.

23. On final expiration of franchise, all fixed property in the streets to then revert to the City except additions made by order of the Commission during the last five years and except unamortized renewals and betterments during this period; these to be purchased by the City at an agreed or arbitrated value.

24. City to have power of entry and supervision of audit of all Company's property and books; the Commission to conduct such supervision of finances, operation, service, and equipment as it deems necessary for the protection of both public and investors.

25. Profit-sharing with the City to be voluntary with Company, in lieu of which a proportionate return to the City is to be secured through franchise taxes on gross receipts, the franchise to be awarded to the highest bidder.

26. Right-of-way to be maintained in such condition as not to damage abutting pavement; franchise obligations in this regard to be construed in such a manner that the right-of-way paving may be in at least as good condition as the street paving; in default of which the City may order repairs at the expense of the grantee, after reasonable notification.

27. Company to be relieved of special obligations constituting a drain upon income not properly a direct charge thereto, such as street lighting, free transportation, etc.

28. Company to be assured protection against avoidable obstruction of its rights-of-way through adequate enforcement of traffic regulating ordinances.

29. Impounding of reserve funds, established for and accruing to the benefit of the City in the decapitalization of property, to be provided against in the event of receivership proceedings.

30. Wages and conditions of labor to be adjusted from time to time through the mediation of the Commission as arbitrator or automatically through the disbursement of the employees' benefit fund.

31. Exemption clause to be incorporated permitting resettlement of existing franchises under specific conditions subject to the approval of the Commission and the voters.

Resettlement Franchises — Supplemental Recommendations

1. Resettlement franchises to incorporate the following provisions: (1) minimum rate of extensions—cumulative; (2) rehab-

ilitation, maintenance and renewals; (3) agreed initial capital or investment value; (4) methods of audit and additions and betterments; (5) amortization of intangible and tangible values; (6) basic return on agreed capital value; (7) apportionment of divisible net receipts; (8) profit-sharing; (9) conditions of purchase, sale, or lease of property.

2. City streets to be cleared of all unused franchises now void from lapse, disuse, non-construction, or abandonment.

3. Period of expiration and operating conditions of all outstanding franchises to be equalized between trunk lines and extensions.

4. Virtual (though not necessarily a contractual) monopoly to be recognized only under the condition that the Company build extensions determined upon or approved by the City through the Commission and to render adequate service thereover up to the limit of a fair profit on the investment in the entire system.

5. Municipal system to follow a policy of co-operative development rather than competition, with the object of ultimate incorporation into a unified system through purchase or lapse of existing franchises.

6. Public Service Commission or an especially organized Board of Control, comprising adequate Company as well as City representation, to have complete and independent administration of such resettlement ordinances involving the profit-sharing plan.

7. Rehabilitation of existing properties to be carried out at a minimum annual rate, assisted by such proportion of the earnings as permitted by a reasonable net return to the Company.

8. Cost of rehabilitation may be carried for a period and capitalized, but with provision for amortizing out of earnings during franchise term all accumulated intangible value due to rehabilitation.

9. Recognized capital investment for resettlement purposes to be the appraised depreciated value of operative property at date of appraisal plus full value of betterments and additions made between date of appraisal and date of settlement (if these dates are within one year of each other, but if more, depreciation on said betterments and extensions to be deducted) and including such initial intangible values as reasonably represent the then (date of settlement) present value of franchise earning power, considering the property operated to expiration under reasonable conditions of up-keep, service and return on investment. The purchase price to the City at any time to be the value thus obtained, less reserve fund accruals, plus the percentage as described in Paragraph 8 of this Chapter under "New or Original Franchises."

10. All accumulated reserve fund remaining undistributed for the purposes intended, to be applied to the reduction of the purchase price at termination of franchise or upon declaration of purchase by City.

11. Company to decapitalize out of earnings all initial agreed intangible values, plus permanent shrinkage in value due to depreciation, during the first franchise period of 20 years; thereafter to decapitalize depreciation and all value represented by fixed structures in the streets and real estate used in the operation of the road, provided, however, that the Company shall have the right to purchase said real estate, at the value fixed in the appraisal, upon which the ordinance was based.

12. City to accumulate out of its share a reserve fund for the following purposes: (a) The purchase of the Company's bonds or stock in the manner of a trustee so as to ultimately acquire the Company's equity in the property; or (b) The gradual acquirement of new property additions by applying all or part of its share to the construction of needed extensions, particularly during the last ten years of franchise life.

13. Extensions to be built by the Company as directed or approved by the City (up to the limit of a reasonable net return), with a fixed minimum mileage for two or three-year periods; this to be cumulative at the discretion of the Commission.

14. Net residual income over prior agreed return to the Company on investment to be divided between City and Company on a profit-sharing plan, with possible provision for a bonus, pension and benefit fund for Labor.

15. Definite period for abandonment and delivery of property by Company to be provided in the event of City purchase to insure uninterrupted operation of the system as a whole.

16. Labor difficulties not settled by the Commission to be arbitrated; but no arbitration to be made within the period of time covered by the last settlement.

17. City's right to initiate extensions and compel connecting service thereon subject to appeal by Company to State Railroad Commission or the Courts, except in case of service over extensions built by City or by assessment.

18. Certification of proper cost of construction of extensions, betterments, and improvements, by the Commission necessary to insure proper entries in capital account.

19. Profit-sharing plan contemplates City representation on Company directorate with stockholders' qualifications, preferably through Chairman of the Commission.

20. In order to avoid delays and brokerage, and upon authorization by the Commission, cash reserve funds for renewals or amortization (but not accident fund) may be used temporarily to meet unexpected, unavoidable or extraordinary demands for money necessary to place the railway property in operating condition as it existed prior to any accident caused by earthquake, fire or other acts of God, and provided further that the Commission shall, at the time such loans are made, see that ample security is provided for the safe return to the amortization fund of all the money so borrowed from said fund, and to the renewal fund the amount expended out of said fund in excess of the actual accrued depreciation (to the date of the accident) of the property destroyed. The difference between the original cost of the property destroyed and the accrued depreciation (to the date of the accident) plus salvage shall be taken from the contingent reserve fund (5) defined in the next preceding paragraph of this chapter, and in case said fund (5) is not sufficient to meet the loss, the difference between said loss and the amount in said fund (5) shall be taken from amortization fund (4) described in the same paragraph.

GENERAL DISCUSSION OF FRANCHISE PROVISIONS

Extensions. The status of a private utility having a practical monopoly for at least 17 years is entirely different from one seeking new franchises. Apparently the City has no power to compel extensions. Therefore, if adequate service is maintained the United Railroads may continue to operate to the end of its franchise term without making extensions.

On the other hand, any new utility or extension to existent ones must conform to the present Charter provisions until amended. For a new franchise, this is simply a question whether the present conditions can be met with profit. But for an extension, the service must be so organized as to permit of one set of operating conditions on trunk lines and another on extensions. This necessarily leads to "shuttle" service over the extension where through service will be demanded, and an involved wage situation. Therefore, if the existing Charter is impracticable for the present system, it will be equally so for extensions thereto, which fact practically debars further extensions in San Francisco, except to the municipal system.

Equalization of Franchise Life. Extension franchises running longer than the trunk line franchise will be of very questionable value after the latter's termination. At best, extensions are usually non-paying for some years. The retirement of investment is therefore even more difficult than on a trunk line, especially in such a short period as 17 years. To adequately protect such invest-

ment, it is necessary that the bonds issued therefor may have a term enough longer to permit of a reasonable sinking fund rate, and that the City assume the unamortized debt at the expiration of the franchise, receiving equivalent property value. The attempt to impose impractical conditions on a short-term extension franchise will prohibit private investment, and therefore either the municipality or the citizens benefited must supply the capital. Equalization of the franchise life upon a just basis between long and short term franchises therefore becomes necessary and desirable so that on expiration, the entire system reverts to the municipality at a given time, when the City is then free to extend its own system.

Early Losses. Extensions must precede rather than follow development of traffic, so that early losses may be expected. Even if a practical method could be found for *accurately* accounting for earnings and operating expenses of extensions, which is not known to me, it would obviously be impossible to retire the true investment out of such limited earnings if it is difficult to do so during the limited franchise term desired on lines of heavier traffic. Extensions must be carried by the trunk lines, and the City logically can only require extensions up to a point where dilution of earnings of the main system thereby reduces the net income to the minimum necessary to support the entire true investment. Should the City itself eventually participate in the net earnings under a resettlement franchise plan, this would automatically operate as a curb to unreasonable demands of its citizens for extensions.

Limited Franchise Term. Although a franchise term limited to 20 or 25 years is desirable from some points of view, it must be recognized that there are definite limitations to the Company's ability to retire its invested capital within such short periods. The necessary investment will be at least $3, and possibly over $4, per dollar of annual income. Therefore, with the fare fixed and a minimum operating ratio, the per cent of income that may be diverted to sinking fund is limited. To retire $100 in 25 years requires an annuity of $2.74, when earning 3%, and $2.10 when earning 5%, compounded. Therefore a reserve representing from 6 to 11% of the income would be necessary to retire the capital alone, neglecting entirely the reserve of 6 or 8% necessary for depreciation and 10 or 12% for maintenance. For complete retirement in 16 years (that is, by 1929) from 13 to 20% of the income would have to be reserved. These figures represent the practical limitations that prevent the investment of capital in short term franchises unless some provision be made as elsewhere discussed herein for the City to assume at the termination of the franchise the underlying funded debt representing actual property in the streets, or in lieu thereof to automatically extend the franchise term for a sufficient

period to permit of the property paying for itself with a reasonable sinking fund. It would then be possible, within a comparatively short franchise term, for a railway company to decapitalize all *that portion of its investment representing intangible value* or property extinguished through depreciation or inadequacy.

Decapitalization. The City Charter permits municipal bond issues running for 75 years with sinking fund payments deferred for 18 years, thus leaving 57 years for actual decapitalization. And even with a revenue producing investment such as water works, it is the practice to decapitalize by long-term bonds.

A street railway should be regarded as a *continuing investment,* as distinct from a property operated to *extinction* such as an investment based on coal mining rights. And any plan of operating to extinction a permanent utility, revenue-producing, as with a short-term franchise, is preposterous from an economic standpoint, especially under the limitations of a 5-cent fare. For it is evident that any utility, similar to the United Railroads property, once established must continue operation *irrespective of ownership.*

This fact has been recognized in Charter Amendment 34, wherein it becomes the first duty of a private utility to decapitalize out of earnings within 20 years such original intangible values as bond discounts, interest during construction, early losses, promoters' profits, and all permanent shrinkage in values due to wear and obsolescence, leaving a residual "present value" representing probably 75% of the reproduction value new. After the cycle of life of the longest lived part of the property has been reached, this condition may then be maintained permanently by proper expenditures for repairs, renewals, and extensions, and will suffice for a high grade operative growing property.

Sinking Fund Reserve. Inasmuch as the primary object of a sinking fund is to retire invested capital, it is only logical that this reserve be used to buy up the securities issued therefor, especially if their market price is below par, for by this means a high interest rate with the best security is obtained. Thus the fund will accumulate faster than if limitations are placed by the City upon the sinking fund investment which results in a return of only 2½% or 3% (such as on bank balances) whereas double this rate is justifiable and satisfactory to investors, the only result will be to lengthen the period of possible retirement of the property if the lower rate is adhered to.

Furthermore, if these sinking fund investments are computed upon a monthly or even quarterly basis, the resulting annuity may be materially decreased, or conversely, the period of retirement shortened.

But a reserve for renewals and depreciation bears an entirely different relation to the property than one for retirement of funded debt, and renewal funds must always be available in cash or readily negotiable securities for carrying on reconstruction work; for upon the integrity of such a fund at the proper time depends that of the financial and operating plan by which permanent shrinkage in property value due to depreciation may be made up out of earnings from time to time as required. The mere writing off of book depreciation does not suffice unless the equivalent ready money is available.

Valuation. Any resettlement plan should incorporate a definite purchase price for the property, including all rights and equities therein to which may be added betterments, additions and extensions of the future. It is not clear to me that a detailed appraisal is immediately necessary at the present time, and in view of the complex franchise status, I am inclined to believe it unnecessary. But if a resettlement is to be reached, the Company and the City must agree upon some figure, presumably *a compromise between the present estimated cost to reproduce new and the present total capital liability.* There are two methods of securing the results desired:

First, a price agreed upon now based upon an appraised valuation in its *present* condition, to which future betterments and additions may be added to obtain the purchase price at any future time. This is the "Chicago Plan," and in most respects is the more satisfactory from the City's viewpoint, as it always provides a *definite purchase price* by eliminating questionable intangible values arising in the future.

Second, appraisal may be made only at such time as the City is prepared to take over the property. Although this deferring of the appraisal might eliminate much extinguished value in the case of a run-down property, yet it is also true that *appreciation* in the value of operating property and real estate might actually result in a higher future "present value," due to a general rise in real estate and commodity prices. With a property normally maintained, it would be certain to so result.

In an extensive rehabilitation there will accrue considerable non-physical or intangible value resulting from the extinguishment of obsolete property; and any purchase price will necessarily contain a certain proportion of such value. Non-physical value cannot be avoided in the organization and construction of any property, whether private or municipal, and it is idle to consider appraisals based entirely upon the bare contract price of labor and material.

For the purposes of a practical resettlement, however, this intangible value is not of such serious consequence, as it will be decapitalized within the minimum period of franchise grant, or before, if possible. This stipulation will secure to the City when ready to purchase, a permanent investment free of intangibles of this nature as well as those due to depreciation, which latter usually represent about 25% of the "cost new value" of the property. In other words under the plan proposed in Amendment 34, the City will be able to buy a high-grade operating property for 75 cents on the dollar, whereas it would cost the City much more than 100 cents on the dollar for the same property acquired by condemnation, *even after waiting 17 years until the expiration of the present franchises.*

Whatever the true physical value of the property may now be, present conditions require the Company to meet bond interest at the average rate of 4.5% on $40,000,000 (or 5.5% including sinking fund), in default of which a receivership and reorganization would probably become necessary. If this debt were refinanced on a 5% basis, an investment of $33,000,000 would represent the *minimum value which the present operators could possibly consider.* If a detailed appraisal were made now, as in the case of Chicago under the 1907 resettlement, a lower value would probably be found for the physical property now in evidence. However, the unquestioned value of the unexpired franchises would be involved as in the "Chicago Plan" which would in effect render the value of the present physical property only one factor in an agreed valuation.

The Chicago valuation, by Court order, even recognized the value under an existing franchise, of a defunct cable property which was immediately scrapped and electrified; and furthermore, franchise value was allowed one company covering 18 months' earnings beyond the determination of its franchise, in recognition of the *right to operate until such time as the City could operate the property.*

Purchase Clause. In order to render a purchase clause effective, it is absolutely necessary that some program of decapitalization be put into effect so that the purchasing power of the City may more nearly keep pace with the necessary investment without diluting its credit through excessive municipal debt. At present the City's ability to purchase is not only inadequate, but is falling further and further behind, as discussed in Chapters 2 and 16. Under an indeterminate franchise, private capital must have assurance of purchase by the City at fair value at the end of its franchise term or before, if the City elects; or in lieu thereof, that it will be permitted to operate during a reasonably extended term until the City can purchase. With a

fixed income (5-cent fare) and the additional burdens imposed herein, the integrity of the investment cannot be otherwise maintained, nor additional capital found to finance necessary extensions.

On the other hand, if the City guarantees the *assumption of the underlying debt* representing real physical property free from intangible values at the franchise expiration, a long-term sinking fund could be employed that would not be an impossible drain on income, that would insure the integrity of the investment, and would enable the City to utilize private capital most effectively as a temporary means to its avowed ultimate end—municipal ownership.

Profit Sharing. Strictly speaking, the principle of profit-sharing between City and Company involves the maintenance of a *regulated* monopoly, in which the City participates as a silent partner and is relieved of the direct responsibilities of operation. This is the case in Chicago. But in San Francisco it is proposed to tax the earnings of a private company for the construction and extension of a municipal utility to be operated in direct competition therewith. This becomes particularly onerous as the City can grant itself rights and commute its financial burdens while denying such special favors to any private utility.

It is true that the present municipal system is not now a serious competitor, but under the City's declared policy it may become so; and although this sharing of residual profits has many advantages, unless the municipal system be expanded along lines of *development rather than competition,* established utilities cannot be expected to co-operate voluntarily in any such plan. It is therefore but just that the City's share in residual net income be applied partly or entirely to the building of extensions to the present system wherever they may be most needed, or to the decapitalization of tangible property to be included in the ultimate purchase price; or else to the construction of supplemental rapid transit lines. While this income might be applied to increased service or the reduction of the fare for the benefit of all citizens, adequate service may better be provided for through exercise of the City's powers of regulation, and in any case it seems that the public now desires and demands a five-cent standard of service rather than a "three-cent service." The small margin of profit which undoubtedly exists in the street railway business today and the rapidly increasing investment due to rapid civic expansion demands, in my judgment, a higher standard of operation rather than a reduced fare, especially on the Pacific Coast.

In the case of other utilities having flexible rates, private operators may be encouraged by a sliding scale of profits under

which exceptional skill in management may be rewarded by an increase in return on the investment, provided that the quality of service is increased at the same time or the rates reduced. Such a plan has resulted in Boston in the reduction of the price of gas from 90 to 80 cents per thousand, and with an increase in dividends from 6 to 8%—and this within one year. But with a fixed 5-cent car-fare, this principle can be applied only through increased service standards. And as this is properly the function of utility regulation now within the City's powers, a simple profit-sharing plan modelled after the Chicago plan, with its acknowledged imperfections removed, seems best for San Francisco.

Several plans operative under the conditions of Charter Amendment 34 have been worked out to finality in Chapter 4; and incorporated therein will be found provisions for *admitting Labor into the profit-sharing plan.* This recognizes the fact that the present unrest and enormous economic losses from strikes may be mitigated or entirely removed by establishing a bonus for Labor in the form of a benefit fund for sickness, accident, death, old age or other disabilities; and also for a bonus to be distributed among the employees for faithful and meritorious service, as determined by a merit system of discipline. Such a plan is now in operation in Philadelphia, by which Labor is practically guaranteed a minimum wage during lean years, and participates in the profits of good years in addition to an insurance fund against disability. This plan has been improved upon herein by including not only trainmen, but all employees receiving a wage of $1500 per annum or under. (See Table 44.)

Wage Scale. With a flexible fare, it would of course be possible to pay any rate of wages within reason, but with a fixed fare, the limitations of the income and necessary expenditures place an absolute limitation upon wages as well as upon all other expenditures necessary to produce a unit of service. With one exception, car men's *wages in San Francisco are now higher than in other large cities,* and in this one exception, no minimum wage or maximum overtime limit of service is imposed. The present U. R. R. time schedule is organized on practically a 10-hour working day,† with only an inconsiderable number of trainmen receiving pay for less than 9 hours work. This schedule results from the fact that a large portion of the railway business is done during the rush hours, morning and evening, each not more than two hours long, with a full *eight hours intervening,* as may be observed from the load diagram, Fig. 23. Good service during rush hours usually requires

†See Graphical Representation, Fig. 91, page 330.

in operated seating capacity about 100% increase over day schedule, which necessarily requires short runs as "extras," "trippers," or "swing runs"; and *the better the service, the shorter will be the average extra run.* It is therefore necessary to split and lap runs to secure a reasonably satisfactory day's work for carmen; that is, to sub-divide the platform time so as to fit into the actual riding habit of the people. Otherwise, it would be necessary to pay a full day's wage for two to four hours of service.

The present Charter fixes the condition of municipal employment, irrespective of the conditions of service, at a minimum wage of $3.00 for an eight-hour working day and overtime at an advanced rate of 50%. But for private companies, the additional burden is imposed by limiting the maximum day's work to 10 hours total elapsed time. Under the above-named conditions of riding habit, this wage scale becomes unquestionably prohibitive, and has been so recognized in Amendment No. 34 on the ground that *the riding habit of the people cannot be reorganized by any kind of legislation.*

Assuming the present time schedule, the eight-hour provisions would introduce a flat increase of 25% in the number of carmen necessary to produce *present* service, to say nothing of improvements therein contemplated in this report. An increase in average wage to 37.5 cents per hour ($3.00 per day) would result in about 40% greater platform expense based upon the income of 1911, and with 1½ overtime rate, a 50% increase in platform expense would result. Finally, with the 10-hour maximum time limit imposed by the Charter, a still greater proportion of short-time men would be necessary, resulting in a further increase in platform expense, the exact amount of which could only be determined by working out a complete schedule covering 750 to 1,000 runs per day. A flat increase of at least 50% over the present wage scale could be safely assumed; even this would prevent the Company from earning a reasonable return upon its bonded debt *or from delivering adequate service under a 5-cent fare, even if the value of the physical property only were considered.*

Distribution of Return. The present situation may best be appreciated from the diagram of income distribution, Fig. 21, and the accompanying graph, Fig. 99, showing the possibilities of varying the return to Company, Labor, and City, respectively. During the calendar year 1911 income was distributed thus:

Company received in fixed charges	35%
Labor received in wages	30%
City and State received in taxes	5%
Public received in service (operation)	30%
Total	100%

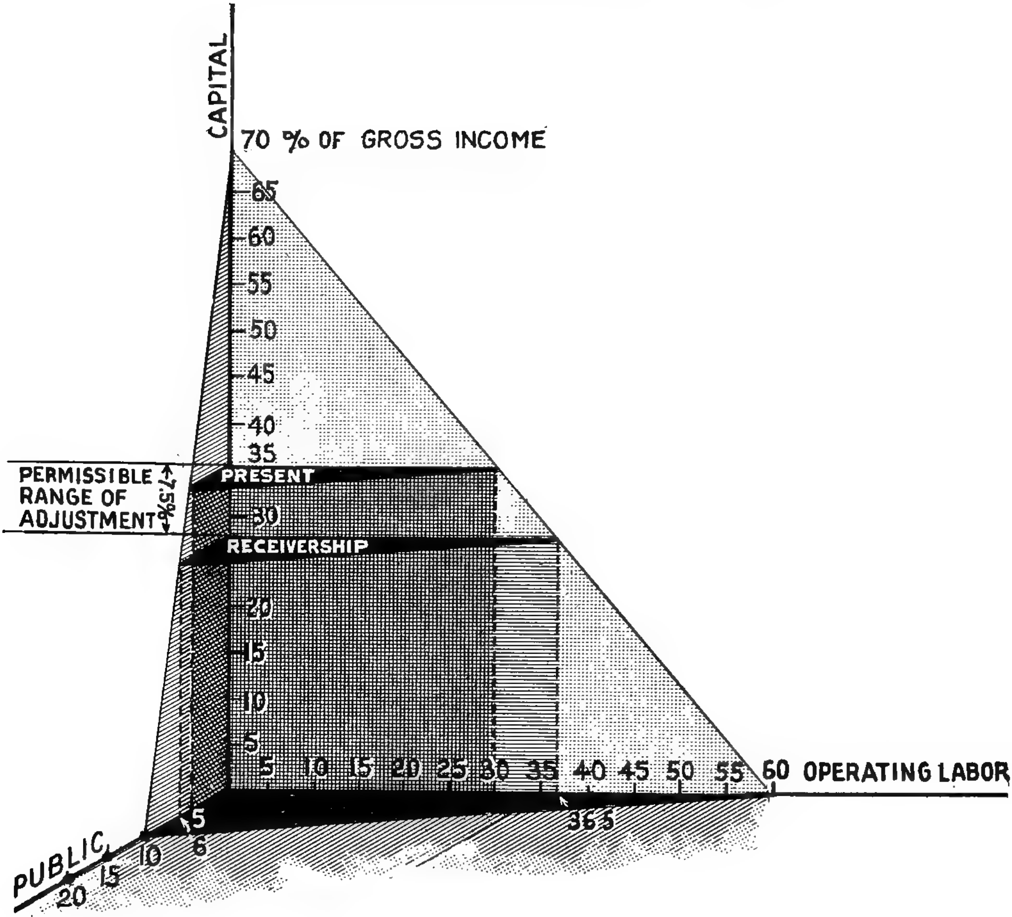


FIGURE 99—PROPORTIONAL RETURN TO CITY, COMPANY, AND LABOR.

Recognizing three principal participants in railway operation, this diagram shows possible division of earnings, based upon the present ratio of return to City (Public) and to Labor. Each of the three scales represents one of the shares. If the height (or ordinate) of any horizontal plane marks the Company's share of income, then the distance to the right and to the left (as indicated by the dotted lines) marks the shares of Labor and City, respectively. Any increase in the shares of City and Labor necessarily decreases the Company's share proportionately, and *vice versa*. Thus the top plane shown represents present (1911) conditions—*i. e.*, City 5%, Labor 30%, Capital 35% (of which 4.67% is used for amortization of part of the Company's bonded debt)—while the lower plane represents that point where further reduction in Company's share *would result in a receivership—i. e.*, Company 27½%, City 6%, and Labor 36½%. Therefore, in any resettlement plan, the range of possible adjustment in Company's share, irrespective of the division between City and Labor, is shown by the interval between the two planes—7½%.

Deducting 5% from the Company's share for sinking fund, equal parts of the income were shared by Labor, Company and Public; or including taxes, *the Public received the largest share in actual return from operation of the property.*

From this income distribution graph, Fig. 99, the effect of reducing the Company's return by increasing proportionately those of Labor and Public will be clear, together with the permissible range of increase before the Company is thrown into a receivership. This range is comparatively small, 7½%, which corresponds to a reduction of only about 2% in return upon actual investment. This graph simply illustrates the fixed elements of a profit-sharing plan, which to be effective must be based upon a fair distribution.

Viewpoints of Private Operators. From my studies on this subject in San Francisco and other cities, I believe the following conditions should be acceptable by enlightened railway executives in a resettlement plan such as proposed herein:

1. Decapitalization of intangible values (including the depreciated value represented by the difference between the cost of the property new and the best condition in which it can be maintained) out of earnings during a 25-year franchise term, and within 40 years, at least so much of the property as is represented by fixed structures in the public streets as well as the depreciated value above noted; City, if it purchases, to assume the underlying funded debt (not exceeding the value of the physical property). Corporation to accept City bonds in part or total payment therefor.

2. Equalization of franchise term for both extensions and trunk lines; future extensions to be initiated by the Company or City as required by district development so far as permitted by the net earnings necessary for recovering the investment during the franchise term; Company to continue operation under an indeterminate franchise until bonds mature if City does not elect to purchase the property before.

3. Ordinary minor franchises for extensions to be passed upon by the Public Utilities Commission in order to save expense and delays; trunk line franchises only to be submitted to referendum; possible dividing line to be drawn whereby all franchises involving construction expenditures in excess of $75,000 or $100,000 should be voted upon.

4. Higher money rates and consequent return on investment become necessary if the City follows a policy of destructive competition; a regulated monopoly is preferable, whether or not ultimate municipal ownership is contemplated.

5. Profit-sharing plan acceptable, except one involving property interests of employees which would give legal title to interest

in property without corresponding financial responsibility; discipline is imperative, and an employees' bonus fund, based upon the merit system, (including an insurance fund for disabilities and contingencies) would be more satisfactory.

6. The ideal municipal ownership plan favored; City to own the property and lease to the highest bidder, who operates, maintains, and renews it out of earnings; unearned increments in physical value thus accrue to the City in the form of higher rental values.

7. In case no Commission is created, the City may very properly have direct representation in the directorate of the operating companies, to the extent of one-third of the voting power, in order to protect its share in the residual income of the property under a profit-sharing plan.

Regulative Control. Regulation should exist as a means of interpreting corporate questions for the benefit of the people in order to permit corporations to *escape the burden of political activity,* and in order to secure operating conditions during their franchise terms that will insure protection to invested capital with a fair profit. Therefore, public service commissions which exist subject to the whim of the appointive political power (without due process of impeachment), or whose decisions and orders may be interfered with or countermanded by municipal political bodies, even though superior in the municipal organizations, are not likely to do effective work, render just and equitable decisions, or conduct themselves as an efficient mediary between Corporation and Public.

It is assumed that at the present time it is not the expectation of the City to relinquish its regulative powers to the State, and that therefore the status of the First and Second District Commissions of New York, both being State-appointed bodies, will not be reproduced here but that a modification of this plan will be adopted, based upon experience with the practical operation of the Chicago Traction resettlement, whereby a Municipal Commission will be created whose decisions will be subject to review by the State Railroad Commission.. While this plan would not seem wise in cities of very limited powers of control over their utilities, it is probably justifiable in San Francisco with its very broad regulative powers. As to the organization of this Commission, the following points appear essential:

1. While the legislative functions of franchise granting should continue to be vested in the Board of Supervisors, representing the electorate, the actual determination of questions relative to rates, service, extensions, equipment, accounting, etc., should be vested in the Commission as already contemplated, but with the additional provision that the Commission should be *clothed with authority to*

enforce its decisions subject to review by the State Railroad Commission or the Courts.

2. The actual management of municipal utilities and the supervision of private ones should be vested entirely in the Commission, with administration by men having sufficient technical experience to insure *results based upon scientific methods.*

3. A unified Public Service Commission covering all utilities is in my judgment essential, with a departmental plan of organization; the Chairman to perform the function of arbitrator, and to be relieved from changing political sentiment through a reasonable tenure of office.

4. In the particular case of a body entrusted with the administration of a resettlement franchise involving the sharing of profits between City and utility company such as the Board of Supervising Engineers, Chicago Traction, the success of the plan evidently depends upon efficient representation of the utilities; but the aggregate voting power of the Commissioners assigned to all participating utilities should not be greater than that of the City representative, with the balance of power always vested in the administrative head.

5. Owing to the essentially technical nature of the business of utility regulation and administration, there should be adequate engineering representation in the Commission; for it is impossible for the layman to pass intelligently upon such questions as operative and construction standards, depreciation, etc. The Chairman particularly should be a man whose experience has been such as to insure a general knowledge of the administration of utilities.

6. In the selection of Chairman-Arbitrator, it is important that this should be done by joint action of municipality and participating corporations, and if agreement is impossible, a selection by some member of the State judiciary could be made in the manner of a Special Master in receivership proceedings.

The above Commission would constitute a co-operative organization for the *practical administration of public utility business,* and not a Court of Justice, which latter function, I believe, is outside of the scope of such a body as is needed in San Francisco to work out its problems. While all company representatives would sit in matters of broad policy, each with a fractional vote, the City's interests are amply protected by the above apportionment of representation, the object of which has been to create an *equilibrium of power* so that neither City nor Companies could exercise undue influence in enforcing demands against the judgment of the Commission as a whole.

CHAPTER 18

PRESENT FRANCHISE STATUS

Deductions from Existing Records
Legal Questions Involved
Franchise Map Records

In order to reach reasonable conclusions regarding the present status and future earning power of the railway franchises existent, a study had to be made of those now on record in the municipal franchise book prepared by the Board of Supervisors, considering the history of each individual franchise from the date of its grant to the present time. From this study, which has been contributed to this investigation by the Board, it appears to be hopeless to attempt any statement upon which franchise values could be positively determined without adjudication of certain legal questions involved, as herein stated. It therefore remains to accept a difficult situation and evolve a new plan of action whereby the uncertainties of the past and present may be replaced by a practicable working plan for the future which will secure the one essential result—adequate service.

General Statement. The United Railroads has acquired through purchase or control of securities the entire traction properties of San Francisco, together with franchise rights, except the California Street cable, the Presidio & Ferries electric, and the Geary Street cable (now the Municipal electric line). Some franchises have already expired, such as the Richmond section of the California Street line. The entire Presidio line reverts to the City in 1913, including roadbed, giving it a most important feeder to Harbor View and the Exposition and the key to the only important diagonal thoroughfare of the city other than Market Street—Columbus Avenue.

The remaining important franchises begin to expire in 1929, when 60% of the mileage and at least 66% of the earning capacity revert to the city according to this study.*

Most of these franchises do not definitely provide for City regulation as to operation, wages, fares, service, equipment, etc. The earlier ones imposed a car license tax but the later ones were generally granted subject to a percentage tax on gross receipts ranging from 2% to 4% maximum. As a matter of fact,

the best paying lines in the city bear no percentage tax, and only about 2% of the mileage pays the 4% rate. The average per cent on gross earnings for the system was 2.032% in 1908,* and 1.89% in 1911. No general provisions for extensions of lines or service were ever included.

Earning Power. It is not generally appreciated what the exceptionally high riding habit in this city means in the earning power of these remaining franchises. If the modified law of the squares be applied, as shown in Fig. 5, Chapter 2, it appears that the gross earnings for the year 1929 will be practically $20,000,000, assuming normal extension of the system (or possibly $15,000,000 without extension). For the entire period earnings would aggregate the enormous total of $238,000,000. An independent check on this estimate has been obtained by compounding the earnings on a 5% basis per annum, resulting in $18,500,000 in 1929, and aggregating during this period $227,000,000.†

Continuing the present operating ratio and all sinking funds carried to maturity, it apears that on either basis the aggregate earnings by the year 1929 will fall considerably short of discharging unfunded debt, even with no dividends paid outside of the first preferred and assuming normal extension of lines with no competition. Both these estimates are based upon the continuance of the present rate of fare—five cents.

Franchise Maps and Expirations. Results of the above-mentioned franchise study are presented graphically herein as the best available method of indicating clearly the complicated conditions that have arisen. They are to be regarded only as *interpreting the existing franchise records,* and are subject to the questionable legal status discussed in this connection. They show graphically the proportion of total mileage which is apparently involved in this uncertainty.

1. Franchises claimed, 1902.....................(Plate 20.)
2. Franchises and permits granted since 1902......(Fig. 100.)
3. Status of United Railroads franchises in 1912..(Plate 21.)
4. Fragments of system remaining after 1929.....(Fig. 101.)
5. Expiration map, from official franchise book...(Plate 22.)

A study of these maps reveals the condition that many unused franchises appear to exist without abandonments having

* Based upon the report of William Dolge, consulting accountant, as of the year 1908, since when the mileage has remained practically constant.

† Between 1899 and 1905 the earnings actually increased at a rate slightly over 5% per annum compounded.

been filed; parts of franchises have been retained and the remainder abandoned without official sanction; some sections now operated appear to have no franchises. There have been numerous lapses, non-conformation to franchise restrictions, departures from specified routings, construction deferred beyond the time limit or neglected entirely, and a wholesale disuse of large parts of original franchises where overlapping grants, given later, rendered such disuse desirable from the standpoint of routing and earnings.

It is apparent that following these questionable matters to a conclusion, in order to establish the respective status of City and Company, involves much litigation and delay, and that an equalization of franchise life would be of unquestioned value to the City after the *principal* problems of contention have been disposed of by agreement or litigation.

Questionable Status. It may be said, on the other hand, that former lapses have been recognized by the municipal government without exacting any official action by which the City has apparently in effect given its "left-handed consent" by allowing the Corporation to proceed of its own free will without requiring it to live up to the terms of its franchise. This lack of effective supervision is not peculiar to San Francisco, but has been the history of utility undertakings all over the country, in which the City and the Corporation must evidently share the blame.

As an example of questionable interpretation, it is found that the backbone of the traction system—the Market Street Railway franchises—are held by the City to expire in 1929, and by the Company, in 1932. About $15,000,000 difference in earning capacity is involved. Further, it is practically impossible at the present time to determine with strict accuracy the amount of percentage taxes on gross receipts under these various franchises, which are interpreted differently by the City and the Company, resulting in a compromise as detailed in Chapter 19.

I therefore strongly recommend, as one of the elements of a resettlement plan, that the City and the Company agree upon some basis to waive these franchise problems of the past, and clear the streets of all unused and unnecessary franchises, including those which are being operated simply to hold the franchise against a possible competitor. This, of course, would only be possible on the following conditions:

First. That franchises so relinquished should not be regranted to competitors; and

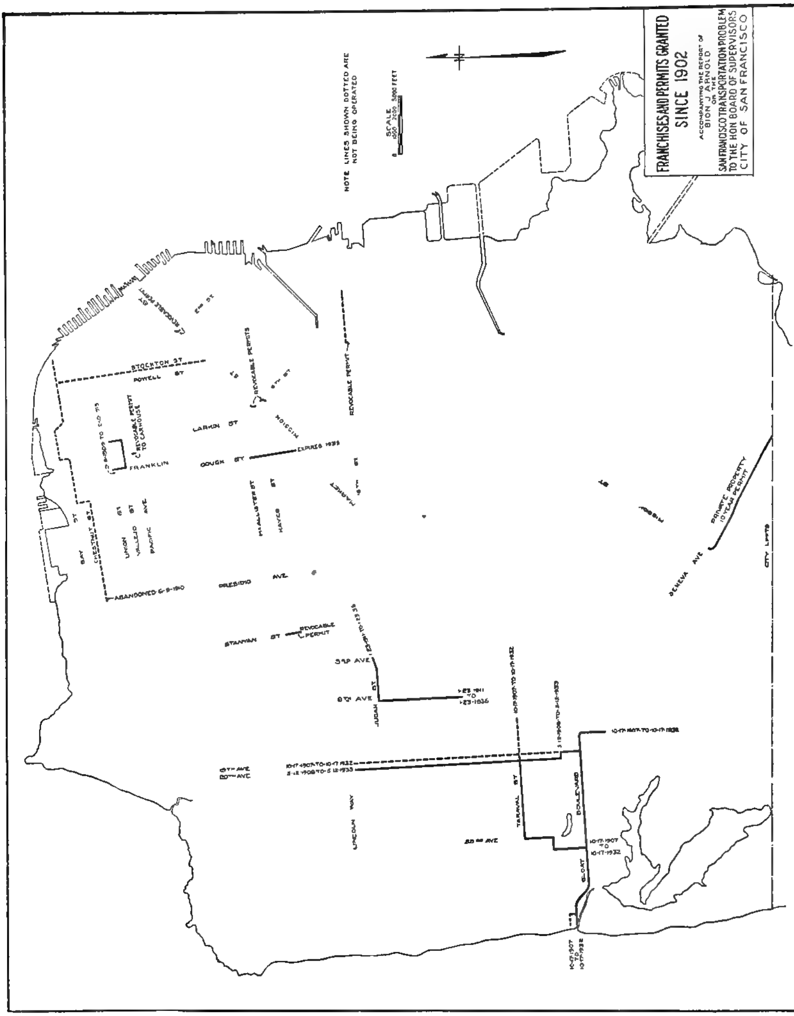


FIGURE 100—RAILWAY FRANCHISES GRANTED SINCE THE CONSOLIDATION OF 1902.

This map gives an idea of the very small number of street railway extensions built since the consolidation in 1902. From this map and that of existing trackage, Plate 1, may be obtained an accurate measure of the expansion of the traction system of San Francisco since the consolidation of the United Railroads. And it is of special significance that no franchises have been granted since the present Charter provisions governing street railways went into effect, nor have any extensions been built excepting those based on prior franchise grants.

Second. That the present Municipal lines forming the nucleus of an ultimate Municipal system should be operated for local development rather than for competition. To introduce indiscriminate competition, either from the Municipal or other private companies, would not, in my judgment, constitute a panacea for traffic evils. Rather, the co-ordination of the present lines as a temporary expedient until the franchises expire or the City purchases the entire property should be brought about.

It may be considered by some that the difficulties in establishing the City's franchise status are being over-estimated, especially in view of the fact that two important decisions have been handed down by the Superior Court in favor of the City, viz.:

1. Sutter Street Ry. outer tracks on Market Street.
2. Market Street Ry. tracks on California Street.

It is true that these decisions are fraught with the greatest importance and value to the City, but it must be recalled that their finality is still to be determined by the United States Supreme Court, and that these represent only a very small proportion of the legal questions to be adjudicated. It has been the experience in Chicago, New York, and other cities, where complex franchise situations have arisen from past neglect and abuses, that final adjudication has resulted in delays which in the end have not entirely served the purpose contemplated and in addition the cities involved have suffered from lack of development and poor service to an extent which proves to my mind *that almost any reasonable working plan is better than a continual legal warfare.*

Typical Legal Questions Involved

1. If a franchise is granted, and subsequently part of the route specified is abandoned in favor of a slightly different route under a subsequent franchise, does this invalidate the entire original franchise, when no abandonment of such part has been filed with or accepted by the Board of Supervisors?

2. Can a company legally operate through service under two different but contiguous franchises along the same street, where the routes specified in the individual grants would not permit through operation?

3. Can an original franchise grant be legally extended for a further period without prescribed abandonment proceedings being gone through, including submission, acceptance, and regrant-

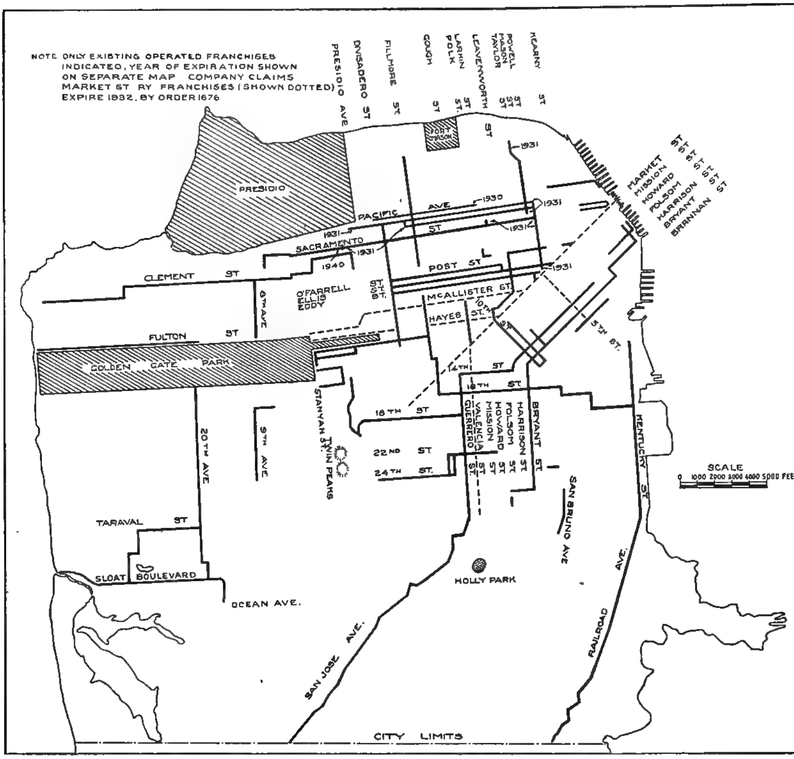


FIGURE 101—FRANCHISES REMAINING AFTER 1929.

The year 1929, when many important franchises expire, will mark an important epoch in the history of transportation in this city; for the fragmentary nature of the railway system then remaining to the United Railroads practically dictates a radical change then, if not long before. Practically no uncertainty exists except in the case of the Market Street Railway franchises (shown dotted) which the Company considers as expiring in 1932 in accordance with amending Order 1676, while by the City's claims, they expire in 1929, as covered by Order 1514. This difference of interpretation involves about $15,000,000—the estimated earnings of these particular franchises for approximately three years. When these franchises expire, the Company's yearly earnings will be reduced nearly two-thirds.

ing by the Board of Supervisors? And does a simple reference in the extension order to the original, without specifying in detail the terms and routes of the original franchise, constitute a legal extension of franchise? Under the State laws, it appears that without definite forfeiture and regranting proceedings an extension cannot be granted by simple order; that is, the extension order must be obtained under precisely the same proceedings as required for the granting of a new franchise.

4. Can two non-related subjects be embraced in a single ordinance; *e. g.*, consent for abandonment, and regrant over the same abandoned route under new franchise conditions?

5 (a). Is a franchise existent and valid if granted subject to Section 502 of the Civil Code, and construction does not start on any part of the routes outlined therein until after the expiration of the number of years exceeding that allowed in Section 502, and no extension of time or other grant has been made to maintain its validity?

5 (b). Or, after the above mentioned period of non-construction has elapsed, does the subsequent construction of a part of the route granted constitute a fulfillment of the conditions and the reclaiming of the rights? The question involved here is the same as in 1—whether the construction of only a part of a route granted, without official abandonment proceedings, invalidates the entire grant.

6. Where a franchise is granted from a given date, "during corporate existence," and the corporation disposes of its properties and franchises to another corporation which continues to operate under the original franchise, does the original franchise right continue so long as the original corporation maintains its corporate existence, whether or not it *has the power to resume operation* under its original rights? In other words, has the original corporation forfeited its charter, or "franchise to be," because of having divested itself of its franchise and therefore become unable to carry out the purposes for which it was incorporated? This question hinges entirely upon the terminology "during corporate existence," and the purpose of maintaining such existence.

7. It is understood that a number of the franchises granted about 1890 contain the following clause:

> "The rights and privileges mentioned in this order are granted to and shall be possessed and enjoyed by said grantees, their successors or assigns, upon such terms, conditions and restrictions as are now imposed *or may be hereafter imposed* by orders of the Board of Supervisors or the laws of the State of California," etc.

8. In the Market Street Railway franchise (and others) the original grant of 50 years (Order 1514) was later amended (Order 1676) for "50 years from and after the passage of *this* Order." Whether this term may be construed as 50 years from and after the date of the original or the amended grant involves approximately $15,000,000 in earning capacity between the two possible dates of expiration, viz., 1929-1932.

SCHEDULE OF RAILWAY FRANCHISE EXPIRATIONS

COMPILED FROM THE OFFICIAL FRANCHISE BOOK OF THE BOARD OF SUPERVISORS.

Year of Expiration	Operating Company		Miles Single Track	Per Cent of Total
Prior	Geary Street Municipal	14.29		
	U. R. R. lines operated without franchise or under revocable permit	10.30	24.590	9.0
1913	Presidio and Ferries Railroad		15.260	6.0
1929	United Railroads	113.4		
	California Street Cable Railway	11.5		
	Sutter Street Railway	1.5	126.400	50.0
	Total Expirations to 1930		166.250	65.0
	United Railroads Mileage Expiring			58.3
1930	United Railroads		11.000	4.3
1931	" "		10.850	4.2
1933	" "		.264	.1
1936	" "		8.834	3.4
1940	" "		28.000	10.9
1941	" "		9.600	3.7
1942	" "		13.400	5.2
1944	" "		7.800	3.0
1947	" "		.419	.2
	Total 1930-1947		90.167	35.0
	Grand Total to 1947		256.417	100.0

CHAPTER 19

METHOD OF COMPUTING TAXABLE RECEIPTS

RAILWAY LINES OF DUPLICATE SERVICE

Special Report Submitted to Finance Committee, Board of Supervisors, December 21, 1912

In accordance with your expressed desire to have my views on the proper method of determining the franchise taxes that may be levied on the receipts of street railway lines operating under existing franchises, I submit herewith such conclusions as I have been able to formulate from the available data and within the limited time placed at my disposal, without unduly interfering with the submission of my report on transportation conditions to the Board of Supervisors. I have endeavored to make clear in the discussion the definite limits of this tax problem and to suggest a means of solution, at least for the present and future. I may also say that after some study, the problem developed many complications that were not apparent when it was first presented to me, and that I am therefore unable to give you a more definite answer upon some phases of it without legal advice.

General Principles

The subject may be discussed from several different points of view:

1st. An occupancy tax from which the City would derive a return for the right of occupying its streets with tracks, irrespective of the uses to which these tracks are put—*i. e.,* irrespective of number of cars or passengers carried.

2d. An occupancy tax which simply recognizes the City's right to tax users of its streets in proportion to the number of vehicles in use.

3d. A usage tax, from which the returns to the City would be proportionate to the relative utilization of these tracks, and therefore proportionate to the income derived therefrom irrespective of the mode of operation or routing as specified in the original franchises.

4th. Each route to be considered as operated by an independent company under the individual franchise conditions now existing.

5th. All routes considered as part of a comprehensive unified system as now operated.

Available Facts

1. Franchises granted in the past have not been uniform in the matter of license taxes exacted from the holders of such franchises. Some franchises contain no provision for the payment of taxes on earnings, and others stipulate that two, three, or four per cent of the receipts, respectively, on all lines operated under such franchises shall be paid to the City.

2. The reorganization of the unified system has been carried out in such a manner that the original identity of many of the routes specified in the franchises has been completely lost, without official recognition by the municipality of the validity of such changes. In the absence of such recognition, it therefore is a legal question whether the original terms of the franchises are being carried out in such a manner as to permit of the direct application of the definite provisions therein, including the computation of percentage payments. Consequently, some modified method of accounting may be necessary to determine the taxable receipts under changes in routing that may obtain from year to year.

3. In several cases, taxable routes now operate over sections of line which are not taxable, according to the original franchises, and conversely, exempt routes operate over sections of line originally granted under percentage franchises.

4. Definition of the term "taxable receipts" in the franchises is not specific, but for purposes of uniformity, has been audited on the basis of passenger earnings (revenue) exclusive of other sources of revenue such as advertising and sale of power, which clearly have little relation to either an occupancy or a usage tax.

It will be apparent from the above that there are two distinct problems involved: (a) the operating problem; and (b) the legal question. The latter will of course require study and definition by your City legal department; the former involves matters upon which I am perhaps better qualified to assist you.

The Operating Problem. While the original franchises were granted under operating conditions relatively simple as compared with those of the present time, the immediate problem, as I see it, is the determination of a practicable unit of traffic, as reflected in passenger earnings. This unit is discussed herein.

The Legal Question. It is clear that, as a result of the unification of the various original properties, changes in routing

have been made, ostensibly in the interests of the public, but which have not been officially sanctioned by the legislative body of your city government. It is unnecessary to cite these changes in detail, but the fact that definite supervision and certification of these changes has not taken place in the past may very likely operate to modify the relative position of City and Company through tentative, if not official, recognizance when all of the legal phases of this matter are thoroughly analyzed. At best, it is complicated, as already set forth by your City Attorney when a compromise was suggested by him and accepted by the City during a former administration. I can only suggest that if, after a study of these matters, an agreement could be entered into by the City and Company whereby an equalization of these various percentage taxes and a uniform levy could be secured, the results in clarifying the situation and simplifying the accounting would be of advantage to the City, and well worth the effort.

The question of an occupancy versus a usage tax is not directly involved in the operating problem and should be determined from a study of the original franchises by your Board or through the advice of the City Attorney. Personally, I favor the latter, as far as my own study of the franchise situation has enabled me to reach a definite conclusion.

Viewpoints of City and Company

The theory upon which your accountant has proceeded is that an equitable basis for the computation of the amount due the City and County under the percentage clauses of the various franchises, and *without consideration of transfers,* is "that the taxable receipts are to the gross receipts of any particular route as the taxable mileage is to the entire mileage," and that, "no allowance can be made for the fact that more than one route passes over any given distance of so-called taxable mileage."

As I understand it, the Company takes the position that so long as it pays a percentage tax on one line, which may be regarded as *the equivalent* of that granted in the franchise, it is free to operate as many lines as may be desirable over sections of this route without being taxed thereon unless these additional lines are also distinctly percentage lines *in toto,* but that in the interest of arriving at a harmonious solution, the original line should be taxed the full percentage of the original franchise, and that the remaining secondary or duplicate service lines should bear only a pro-rata portion of taxes according to the number of secondary lines operated (*i. e.,* 50% if only one secondary line in use.)

Your accountant claims that it is immaterial to the municipality whether the route operated is profitable to the Company or not, and that the municipality is not responsible for technical difficulties encountered in determining taxable receipts, which difficulties have arisen as a result of the rearrangement of its routing, subsequent to consolidation of the originally independent properties. In the abstract, I am inclined to agree with this viewpoint, although some concessions may be entirely warranted in the case of routes clearly being operated at a heavy loss, if so authorized by the Board of Supervisors.

There is recommended in both reports of your accountant that the Board of Supervisors require to be submitted from all operating companies complete statements, showing official mileage of franchises by Order numbers, with subsequent changes in routing contemplated. This suggestion should be carried out, as hereinafter modified. It will place in the hands of the Board of Supervisors complete data upon the operation of the City's system, which should in any case be available as a basis or datum upon which the service rendered by the operating companies may be from time to time examined and verified by the proper authorities. This will not only insure to the City the proper performance and service under the schedules submitted, if adequate inspection is carried out, but also insure the Company against unwarranted criticism of its service.

The introduction of additional complication of transfers in the determination of receipts between interconnected systems or lines is not believed to be a matter of consequence, for the great advantage to the riding public of liberal transfers is so apparent as to outweigh a possible gain by basing taxable receipts upon receipts from other than *actual originating traffic.*

Taking the extreme viewpoints in this problem, it may be held, on the one hand, that:

1st. When any line operates over a section of track granted by the City under a percentage clause, this line becomes a percentage line, whether occupying this track exclusively or in part, and all of the receipts of such line should be taxable in full under the percentage clause of the underlying franchise, and that it is immaterial to the City what changes in routing take place, so long as the usage tax contemplated is paid in proportion to the total traffic. And, on the other hand,

2d. It may be claimed that the original intent of exempt franchises should be perpetuated, even though some changes in routing have taken place and thereby bringing certain proportions of the exempt lines within the pale of percentage clauses

of underlying franchises, because the City has directly benefited by this re-routing, as a result of the unification of the properties by consolidation with its attendant increase of transfer privileges.

Both of these viewpoints I believe to be untenable in the present situation, and that a much more reasonable solution of the difficulty would be that whatever sections of line or street have been enfranchised under clauses providing for the taxation of receipts, these sections should continue to derive full per cent tax from all traffic *originating thereon*, whatever routings may exist beyond the limits of such section of line; in other words, that these underlying franchises should hold their full percentage, but only on the originating traffic.

Originating Traffic. Were it possible to obtain this actual originating revenue traffic, the computation of returns to the City would be simple. Theoretically, this revenue should be based upon *passenger mileage* over the given section of line, with a unit income per passenger-mile derived from the total income of the system divided by the total passenger mileage operated during a given period. But in the absence of the latter (which cannot be determined in a system with a flat 5-cent fare throughout), this is absolutely impracticable.

The originating revenue traffic might also be determined upon a similar basis of seat mileage, car mileage, route mileage, and totalized track mileage, and finally by actual difference in registration in the number of revenue passengers recorded at the beginning and at the end of the percentage section of line. But the last-named method would again require an incommensurate amount of labor and expense on the part of the City for verifying this registration, unless conductors' registrations were acceptable. And even in this event, it is apparent that the City would then derive no revenue from *through traffic not originating* within the percentage section of the line, which is not in accordance with the spirit of the franchise clause as a usage tax. Furthermore, the transfer traffic using this section, but originating elsewhere on the system, would be neglected.

Practical Bases of Computation. For the purpose of avoiding the annual expense of audit, and the delay resulting from an adjustment of the opposed conceptions of this tax, the simplest method is unquestionably that based upon proportionate route mileage, which has been used heretofore. But it must be admitted that this basis conforms more nearly to the conception of an occupancy tax than to a usage tax, and herein has arisen most of the contention in the interpretation of "duplicate

service." In other words, taxes are imposed on line receipts originating mostly in other sections of the city, which are exempt from percentage tax, even though practically no traffic originates within the percentage section under consideration.

If the conception of the usage tax is finally accepted as controlling the assessment under these franchises, it is clear to me that a basis must be used wherein the assessment levy is approximately proportioned to the usage or traffic over such percentage sections of line. The only condition under which the route mileage basis would be even approximately correct would be where all cars on a given line or route operate from terminus to terminus and no short-haul trippers are operated, which is neither the case now nor in accordance with scientific routing. A satisfactory approach to the correct basis cannot therefore be obtained by using the proportionate mileage of each individual route, as your accountant has done.

Recommended Method. I can see no alternative but to accept the next approximation—viz., car mileage—especially in view of the re-routing which I shall recommend to the Board of Supervisors. In the case of the Polk Street line, I was satisfied that the route mileage basis would suffice, inasmuch as practically all of the cars would run the full length of the route; that is, to the Exposition loop. But for the computations on the existing system, I believe that the most equitable result would be secured by computing the taxable returns to the City as follows:

The taxable receipts of any route bear that proportion to the receipts of the entire route as the car mileage over the given section of percentage track bears to the total car mileage operated over the entire route, this car mileage to be determined as the average operated during the year as based upon official schedules submitted, and to include revenue mileage only.

The inclusion of all contributing routes on a full taxable basis appears justifiable on the theory that if each individual route were considered as operated by an independent company, there would exist no valid reason for discrimination between them, unless by definite agreement with the Board of Supervisors in authorizing such a departure from the provisions of the underlying franchise.

This basis requires no arbitrary approximations by either the City or Company, as is now under contention, nor arbitrary assumptions as to primary, secondary, and tertiary lines, which assumptions are always open to argument; it imposes a percentage tax practically in proportion to the usage of the streets for passenger revenue purposes; and it equalizes more nearly in ac-

cordance with originating traffic the assessment on outlying exempt franchises in which duplicate or multiple service is involved. It necessarily requires operation by fixed schedule (which in any case is desirable from the standpoint of convenience to the public) and the verification of such schedules by the City from time to time, together with the full knowledge of and certification to any schedule modifications that the Company may desire to make.

It is true that a still closer approximation to the ideal might be made by adopting a basis of seat mileage instead of car mileage in order to recognize the difference in the size of cars operated throughout the system, thus coming one step nearer to the theoretical passenger mileage. But inasmuch as it is a practical impossibility to operate without an occasional interchange of equipment due to accidents, emergencies, and other causes, this introduces an additional complication and expense of audit, both on the part of the City and of the Company, which I believe is not warranted under present conditions.

Basis of Settlement. In view of the expense and delay already incurred in the adjustment of this question, I am of the belief that some such compromise as was entered into subsequent to the submission of the first report of your accountant in 1908 be applied to the settlement of the calendar year now under consideration, ending December 31, 1911; but that all future computations be made upon the car mileage basis as above recommended and that steps be taken to secure the continued submission of schedule data necessary for the proper audit without incurring the labor and expense involved as in the past. Such operating records as will be found (see Chapter 7, Rerouting) in my report on transportation conditions will furnish a guide for the City in this matter. And some person or persons qualified by experience in the knowledge of railway operation and schedules should be delegated to analyze and report to your Board. In case a *City Public Service Commission* is established, such matters would logically come within its jurisdiction.

APPENDIX

REVIEW OF TRANSIT DEVELOPMENT IN SAN FRANCISCO

Past records of early development, while not always of immediate value, nevertheless offer guidance in avoiding the repetition of previous blunders. Further, they help the student of civic affairs to form an adequate conception of local difficulties that have been met and overcome, and particularly to follow the general trend of corporate and public opinion upon such matters as transportation, for example, in regard to types of car, competition, methods of financing, franchise terms, and municipal ownership. The facts presented have been gathered from all available sources not only during the study of corporate property and finance, but also in connection with the franchise study contributed by co-operation of the Board of Supervisors. The exact historical accuracy cannot, of course, be verified beyond that of the records available.

CHRONOLOGY

1776. First settlement on the Peninsula by Franciscan missionaries near what is now Sixteenth and Dolores Streets. A few years later the village "Yerba Buena" was settled on the Bay shore between Clark's Point and Telegraph Hill.

1839. Streets laid out in Yerba Buena.

1847. Name of town changed to San Francisco.

1849. First period of rapid population growth following the discovery of gold. City increased in population from 2,000 to 15,000 within a year.

1850. Plank-paved toll roads constructed on Folsom and Mission Streets under eight-year franchise. At this time horses and vehicles provided by livery stables furnished the only means of transportation.

Omnibus Period—1852-1862

1852. Rapid increase in population resulted in the establishment of the first regular transportation facilities in San Francisco—an omnibus line (Yellow Line) operated by Crimm and Bowman between postoffice at Kearny and Clay Streets, and Mission Dolores, via Kearny, Third and Mission. Headway 30 minutes. Fare 50 cents, $1.00 on Sundays.

1854. Second omnibus route put into operation to Mission Dolores by Yellow Line via Folsom and Sixteenth Streets; in 1855 commenced operation on a 10-minute headway between Third and Townsend Streets and Meigg's wharf—fare 15 cents, later reduced to 10 cents. Shortly afterwards a line was started between the Presidio and the postoffice, running every hour.

1857. First opposition omnibus line started—People's or Red Line—operating a 30-minute headway to Mission Dolores and a 10-minute headway between North Beach and South Park, later reduced to five minutes.

1857-1862. Other omnibus lines entered the field, and the routes were expanded considerably. Fares finally became standard at 10 cents. Drivers were paid $2.50 for a 12-hour day. In 1862 the Red Line had receipts of about $66,000, and operating expenses of $50,000. At that time the population of the city was about 50,000, and was rapidly outgrowing the omnibus system.

Horse Car Period—1860-1872

1857 Legislature granted Thomas Hayes a franchise for the first street railway in San Francisco, along Market Street from California to Mission Dolores.

1860. The San Francisco Market Street Railroad Company, afterwards the Market Street Railroad Company, took over franchise, graded Market Street, and built the line, which was operated at first by steam dummy power, and later by horses. This railroad was put in operation at about the same time as the first street railway in England. In 1863 the line was extended to the water front and to Twenty-fifth and Valencia Streets. Headway, 30 minutes.

1861. Omnibus Railroad Company, formerly the People's or "Red Line," was incorporated following the immediate success of the Market Street Railroad, which materially reduced traffic on the omnibus lines. Its franchise approximated the old omnibus routes, and the system was put into operation in 1863.

1861. North Beach & Mission Railroad, formerly the "Yellow" Omnibus Company, was incorporated and built lines approximately following the old omnibus routes.

1861. Central Railroad Company formed and received franchise from the Ferry (foot of Vallejo Street) to Sixth and

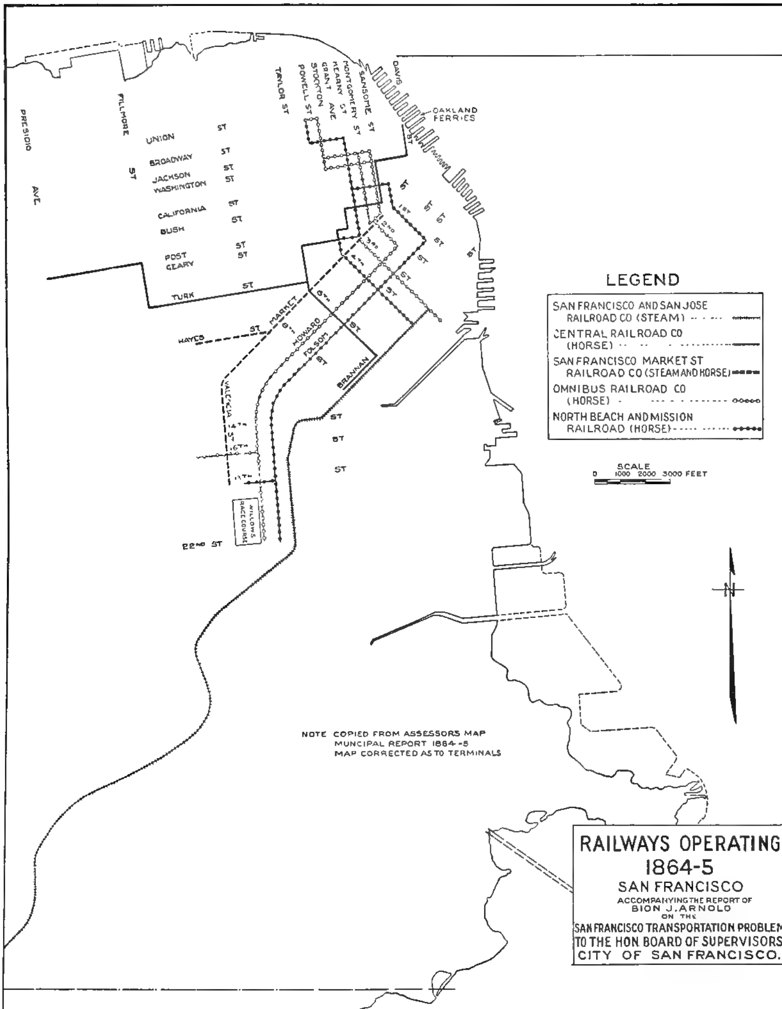


FIGURE 102—RAILWAYS OPERATED IN SAN FRANCISCO, 1864-5.

As representing the early conditions of street railway transportation here, this map shows clearly the concentration of traffic within the Mission district, south and east of Market Street, and the resulting limits of travel.

Brannan, following very closely part of the present Sixth and Sansome Street route; and from Taylor to Lone Mountain Cemetery on Turk Street. The first mentioned line traversed the most thickly settled sections of the city, and is said to have had very high receipts.

1863. City Railroad Company formed to carry patrons to Woodward's Gardens, an amusement resort between Thirteenth, Fifteenth, Mission and Valencia Streets. The original line started from Second and Mission,† but was extended from time to time to Twenty-sixth and Mission and to the Ferry, and to Dupont and Bush via Fifth and Market. All extensions were built out of earnings.

1863. First train operated between Mission Dolores and San Francisquito Creek by the San Francisco & San Jose Railway Company, which ran four trains daily. Later the line terminated at Market and Valencia; and occasionally up to 1868, when steam operation was forbidden on Market Street, trains landed passengers in front of the Palace Hotel.

1864. Legislature granted Abner Doble the right to construct a tunnel through Russian Hill from Mason to Hyde or Larkin Street. This is the same location as the Broadway tunnel recently proposed and indicates how early the necessity for a tunnel under that ridge was recognized.

1866. Front, Mission & Ocean Railroad, incorporated 1862, (later the Sutter Street Railway Co., incorporated 1887) built a line from Broadway and Battery to Broadway and Polk via Battery, Sutter and Polk.

1866. Potrero & Bay View Railroad Company built an expensive line to the racecourse on Bay View Avenue, requiring the construction of two bridges, each a mile long, and much excavation in Potrero Hill. At this time all franchises specified a 5-cent fare on horse-car lines, but in view of the expensive construction of the Bay View line a charge of three tickets for 25 cents and an extra fare below Islais Creek was allowed.

The other companies finally succeeded in raising their fare to four tickets for 25 cents, following a Court decision that they could add the Federal tax to their fare.

†Also New Montgomery and Market Streets.

1866-1870. Period of real estate speculation. Numerous franchises were granted, but many lines were never built. Great real estate activity was caused about 1869 by the completion of the Central Pacific Railroad.

1868. Market Street Railroad obtained additional franchises "to construct an iron railroad of double or single track" on McAllister to Laguna, on Hayes to Divisadero, and Market from Valencia to Castro. This franchise with the original grant covered practically all of the lines later operated by the Market Street Cable Railway Company.

1870. Eight railway companies in operation with 35 miles of single track and from three to four cars operated per mile.

1870. Act of the Legislature gave cities the right to grant franchises to street railways for terms not exceeding 25 years; maximum fare 10 cents, work to be started within one year and completed within three years.

1871. Front, Mission & Ocean Railroad (then known as the Sutter Street Railroad) extended its line from Polk Street to Presidio and Geary via Bush, Fillmore, California and Presidio, and also to Harbor View.

1875. Extract from city directory under the head of "Railroads": "It is hardly too much to say that the modern horse car is among the most indispensable conditions of modern metropolitan growth. It is to a city what steam car and steamship lines are to the state and the country. In these modern days of fashionable effeminacy and flabby feebleness, which never walks when it can possibly ride, the horse car virtually fixes the ultimate limits of suburban growth."

Cable Railway Period—1872-1891

1869. Cable railway system invented by Benjamin H. Brooks, a San Francisco attorney, and partly developed by him.

1873. Clay Street Hill Railroad Company, the first cable line in the world, started operation on Clay Street from Kearny to Leavenworth, and later extended to Van Ness Avenue. Cable system perfected by A. S. Hallidie and line built at a cost of $68,000 per mile of single track. It was very profitable from the start, often paying in a single year as much as 35% of the money invested.

FIRST CABLE LINE IN THE WORLD, CLAY STREET HILL R. R.—1872.
Also Geary Street steam dummy—1880.
—Courtesy Gabriel Moulin.

1873. Rate war between the City Railroad, Omnibus Railroad, and North Beach & Mission Railroad. Fares dropped to eight tickets for 25 cents.

1875. Agreement between all roads excepting the Clay Street Hill line fixing fares at four tickets for 25 cents. At this time the dime was the smallest coin in circulation in San Francisco, and the charge for a single fare on all roads was ten cents.

1875. Eight companies in operation, having 80 miles of single track and 220 cars; 700 men and 1700 horses employed.

1876-1880. Sutter Street Railway Company changed from horse to cable power. Extended the Sutter Street line to Presidio and built Larkin Street line from Market to Sutter.

1877. Law enacted by the Legislature (effective 1878) fixing fares in San Francisco at five cents.

1877. Ocean Beach Railroad Company incorporated.

1878. California Street Cable Railroad Company, incorporated 1876, put line into operation between Kearny and Fillmore Streets. Built by Leland Stanford and associates, at a cost of $430,000. Construction first-class through-

out. Equipment, 25 cars. Grip cars or dummies seated 18, and trailers 16 passengers.

1879. Franchise extensions of 50 years granted to practically all companies just prior to the adoption of a new State constitution.

1880. Presidio & Ferries Railroad Company started operation over a line approximating the present route, using a combination of horse, cable and steam dummy power.

1880. Geary Street cable line built from Kearny to Presidio Avenue; Golden Gate Park extension via Point Lobos and First Avenues, operated as a steam dummy line. Cost $370,000. Constructed with plank conduit, but later reconstructed to standard concrete conduit and steel yokes.

1882. Market Street Cable Railway Company formed by Stanford and associates; took over all lines of the Market Street Railroad and reconstructed them into cable lines. Capital, $5,000,000. Construction of roadbed first-class, and even withstood the earthquake of 1906, except where the support was entirely carried away.

1884. Park & Ocean Railroad Company, organized 1883, put into operation as a steam line to the Beach.

1884. Telegraph Hill Railroad started operation of a cable line up Telegraph Hill. Operation ceased about 1886.

1885. Powell Street Railroad system built from Powell and Market to Taylor and Bay Streets, and from the Ferry to Presidio Avenue via Sacramento, Clay, Washington and Jackson. Later the Sacramento Street line was extended from Mason to Walnut Street, and afterwards to Golden Gate Park via Sixth Avenue.

1886. Market Street & Fairmount Railroad Company incorporated (a subsidiary of the Market Street Railway). Operation commenced in 1889. Castro Street cable line constructed.

1886-1889. Expansion of cable lines on Ellis Street from Market to Broderick, via Oak, Stanyan to Haight; on Post, Market to Leavenworth, Tenth to Howard; Howard Street horse car line converted into cable to Twenty-sixth Street, and line built on Twenty-fourth Street east.

Period of Electric Construction and Consolidation—1891

1891. San Francisco and San Mateo Railroad Company, the first electric line in San Francisco, built by Mr. Behrend Joost from the corner of Steuart and Market to the

County line, via Steuart, Harrison, Fourteenth, Guerrero and San Jose Avenue. This road did not pay expenses, and failed after a short time, but was afterwards rehabilitated and extended to the Holy Cross Cemetery, and over the present Harrison and Eighteenth Street "switchback line."

1891. Metropolitan Railroad built from Market Street to Golden Gate Park via Eddy, Hyde, O'Farrell, Scott, Fell, Baker, Page, Clayton and Waller to Ninth and "H" Streets. This road was purchased by the Market Street Railway Company in 1894.

1892. Southern Heights and Visitacion Valley Railroad Company incorporated. Operated on Kentucky Street and Railroad Avenue.

1892. War of competition between the Omnibus Railroad and the Market Street cable roads, at that time controlled by Southern Pacific interests. Both extended their lines rapidly, and numerous attempts were made to stop construction by armed force. There were several fights over attempted extensions south of the Park. During this time the Omnibus Company put 15 to 20 cars on the Market Street outer tracks below Kearny, and blanketed the inner tracks. The Omnibus Company finally forced purchase and consolidation.

1893. Stock of the Omnibus Railroad purchased by the interests controlling the Market Street road, which at that time had obtained control of practically all the other lines in the city.

1893. Market Street Railway Company organized by "Southern Pacific interests" consolidating all lines with the exception of the San Mateo, Sutter, Geary, California, and Union Street lines. This was the first large consolidation of competing lines.

1893-1901. Period of unification of the Market Street Railway system during which old routes were changed to a considerable extent, and many sections of track abandoned. From 1896 to 1901, the extensions on all of the systems just about equalled the abandonments.

1895. Adolph Sutro built an extension from the end of the Sutter Street line via California and Clement Streets to the Beach in order to secure a 5-cent fare to the Sutro Baths, which was refused by the Market Street Company. This road did not pay, and was eventually sold to the Sutter Street Railway Company.

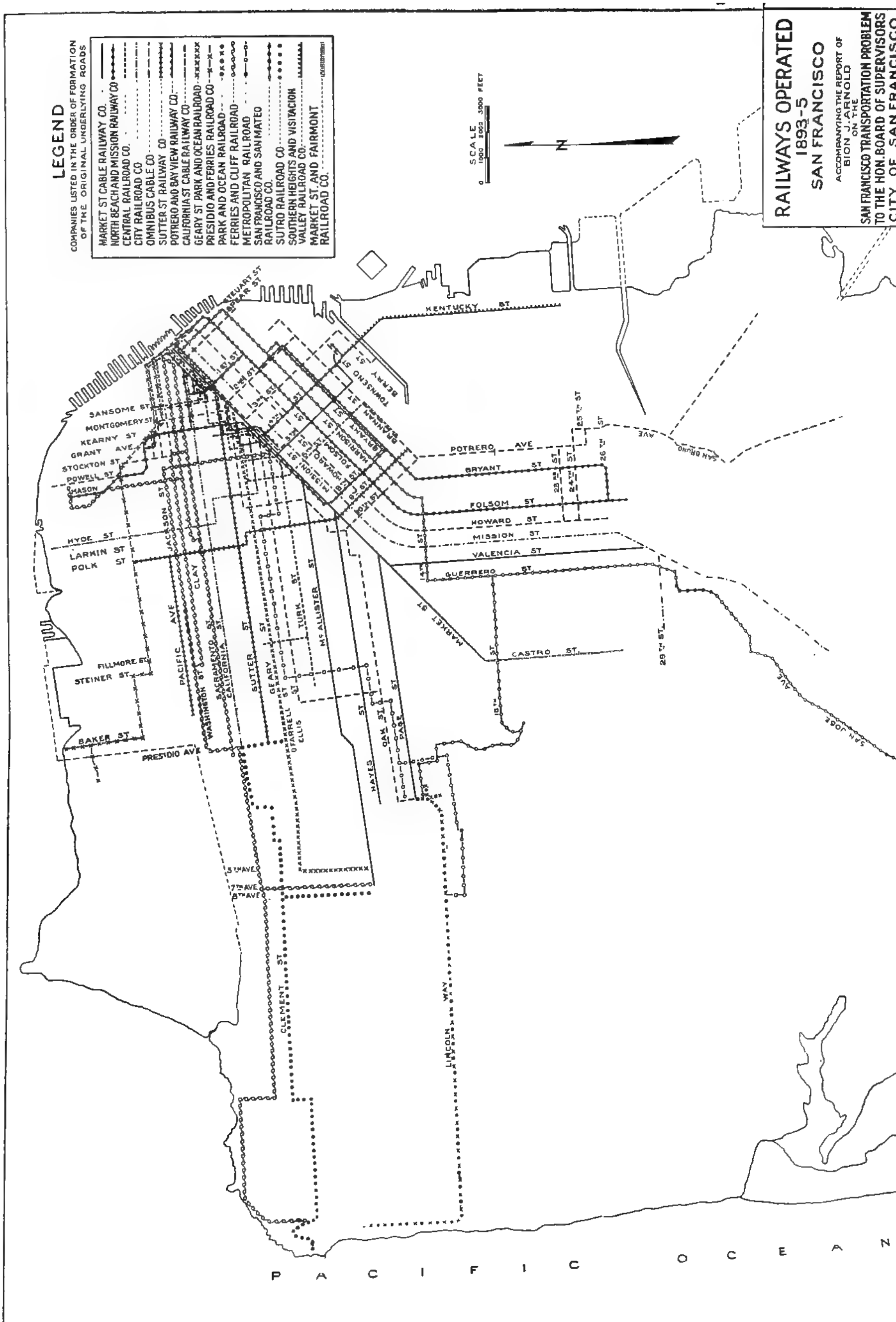


FIGURE 103—RAILWAYS OPERATING IN SAN FRANCISCO IN 1893-5.

This exhibit is of particular interest as indicating conditions prior to the first general consolidation of railway lines. The large number of separate companies operating at that time is shown by graphical code; also the complicated system of lines and routes, some of which have since been abandoned. The advantages to be derived from the consolidation in obtaining for the Public unified operation and more direct routing, and for the Company, the elimination of duplication of service, are here quite evident. This complexity of routing and duplication of investment is most noticeable in the North Beach section.

1900. San Francisco & San Mateo system purchased by the "Baltimore Syndicate" for $1,200,000. This formed the nucleus of the present United Railroads system.

1900. New City Charter adopted, declaring for gradual acquisition of and ultimate municipal ownership of public utilities.

1902. United Railroads organized by Brown Bros., New York, consolidating all railroads operating in San Francisco with the exception of the California Street Cable, Presidio & Ferries, and the Geary Street lines. This was the second and last important consolidation.

1903. Charter amendment declaring right of regulating rates and service.

1906. (Apr. 18th) Earthquake and fire temporarily stopped all street railway communication within the city. United Railroads provided food and clothing and the assistance of their trainmen and free transportation during the early days of greatest distress. Fillmore Street cross-town line first to resume operation, and traffic practically recovered in seven months due to extraordinarily rapid rebuilding.

1906. (Aug.) First carmen's strike, 10 days.

1906-07. All United Railroads cable lines were electrified excepting Castro, Powell, and Sacramento cables.

1907. (May 5th) Strike of platform men practically stopped the operation of the United Railroads system, but finally resulted in a victory for the Company after a prolonged and brutal struggle in which armed force was frequently resorted to. Traffic did not fully recover for about one year. This turbulent fire and strike period resulted in about $5,000,000 loss in United Railroads earnings and gave rise to further punitive legislation.

1907. (Oct.) Charter amendment providing for acquisition of public utilities by City and extending right of regulation.

1910. Charter amendment declaring for City purchase of utilities, limiting minimum wages and maximum hours of work except for City employees.

Municipal Ownership

1896. Supervisors attempted to extend the franchise of the Geary Street road. Court decided that Supervisors had no right to extend a franchise prior to one year before its expiration.

1900. New City Charter went into effect declaring for municipal acquisition and ownership of public utilities.

1902. First election on Municipal Railway, bond issue of $700,000 to rebuild the Geary Street cable road with an electric conduit. Failed to receive the necessary two-thirds majority. Vote about 15,000 to 10,000.

1903. Franchise of Geary Street road expired. Second election of Municipal Railway bond issue. Lost, 14,000 to 10,000.

1905-6. Tax levy of $700,000 provided for to build the Geary Street road. This money was diverted to other purposes at the time of the fire.

1909. (June) Third bond election for Geary Street road fell 431 short of the necessary two-thirds majority.

1909. (Dec.) Fourth election. Bond issue of $2,120,000 for the construction of a municipal system passed by vote of 28,000 to 7,000.

1911. Rebuilding of the Geary Street line commenced. Construction changed from day labor to contract basis after election of new administration.

1911. (Sept.) Judge Seawell ruled in favor of City's right to operate Geary Street line to the Ferry over tracks laid by the Sutter Street Railway Company.

1912. (Mch.) State Railroad Commission, reorganized under Public Utilities Act, given power of regulating rates and service except in cities then holding and retaining such powers.

1912. (Dec.) Administration enters into agreement with United Railroads respecting joint operation on lower Market Street.

1912. (Dec.) Charter Amendment 34 defeated by small majority. This was a broad enabling act designed to permit new and resettlement franchises to be granted on the indeterminate profit-sharing plan, with automatic recapture by the City unlimited extensions and adequate service. Amendments also defeated providing for City Public Service Commission with regulative powers over utilities and for exemption of revenue producing utilities from the existing 15% debt limit.

1912. (Dec.) Municipal railroad on Geary Street commenced operation.

1913. Geary Street extension to the Ferry delayed by petition for referendum on legality of agreement.

SUPPLEMENTAL DISCUSSION

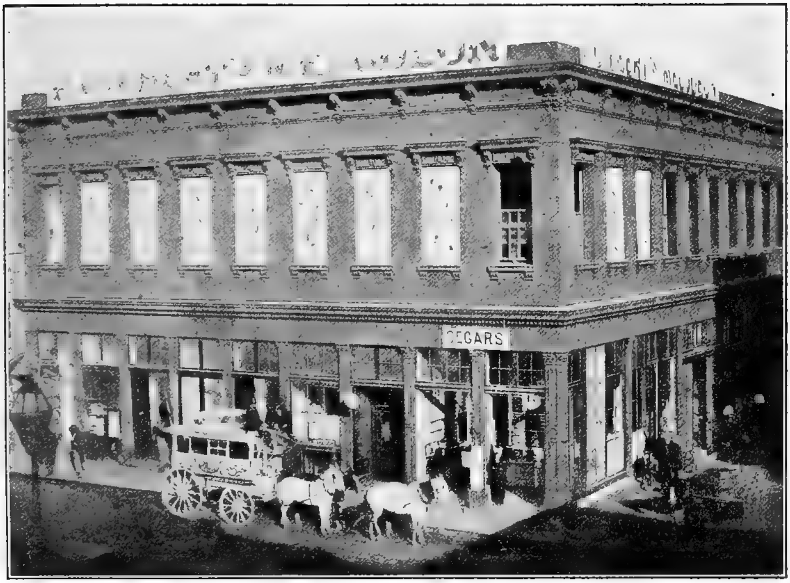
Suburban Transportation

Regular Ferry service between Oakland and San Francisco was started in 1852 with two trips daily, increased in 1858 to three. On the Oakland side, passengers were landed at the foot of Broadway until 1863, when the Oakland pier was built. By 1873, the passengers carried numbered 2,655,671 which had increased by 1877 to 5,570,555, and by 1912 to nearly 40,000,000. Originally, the single-trip fare was 15 cents, and the monthly commuter rate $3.00, the same as at the present time. Ferries were also run in 1877 to Sausalito and to Berkeley making about six trips daily, the same rate of fare being charged. In 1863 the San Francisco & San Jose Railroad was built, with four trains daily run from Mission Dolores (Sixteenth and Dolores Streets) to San Francisquito Creek; later trains were run to a depot at Market and Valencia, and occasionally down Market Street, landing passengers at the Palace Hotel. This was discontinued in 1867, when an ordinance was passed forbidding operation by steam on Market Street.

Fares

On the original omnibus line, the fare from Kearny Street to Mission Dolores was 50 cents on week-days and $1.00 on Sundays: and from South Park to North Beach, 15 cents one way. But when the opposition omnibus lines were started the fare to Mission Dolores was reduced to 25 cents, and from North Beach to South Park to 10 cents, which ultimately became the standard omnibus fare. On the first horse railroad the franchise provided for a 5-cent fare when two or more passengers were paid for, or 10 cents for a single passenger, since 10 cents was the smallest coin in circulation. The companies finally succeeded, however, in raising the fare to four tickets for 25 cents, under a Court decision giving them permission to add the amount of the Federal tax. After the adoption of tickets, the companies found that they realized considerable additional revenue due to tickets lost or unused by passengers.

The high construction cost of the Potrero & Bay View Company's line was recognized, and permission granted to sell tickets 3 for 25 cents and to charge an extra fare to the Bay View racecourse. About 1872 the City Railway carrying people to an amusement resort in the Mission (Woodwards Gardens) cut the fare to six tickets for 25 cents, resulting in a rate war with the Omnibus and the North Beach & Mission lines, during which time as many as eight tickets were sold for 25 cents. In 1873 an agreement was



BEGINNINGS OF TRANSPORTATION IN SAN FRANCISCO—1860.
Omnibus, corner Clay and Montgomery Streets.
—Courtesy Chas. B. Turrill.

reached and fares restored to five tickets for 25 cents. But two years later all lines except the Clay Street cable raised the fare (without notice to the public) to four tickets for 25 cents. This resulted in numerous riots; the fare question became a political issue, and finally an Act of the Legislature (effective 1878) fixed street railroad fares in San Francisco at 5 cents. The effect of this reduction was an increase in riding of about ten per cent. For a time after the Market Street consolidation the transfer system was not altered, and an attempt was made to collect additional fares on many of the lines. This resulted in lawsuits in which the Company was fined $200 for each violation of the State law of 1878. Since that time a uniform 5-cent fare has been charged in San Francisco, with universal transfers between all lines under one control.

Rolling Stock

The first equipment used for transportation in San Francisco was the omnibus, with two or four-horse teams, and seating about 18 passengers including seats on top. No standing passengers were allowed.

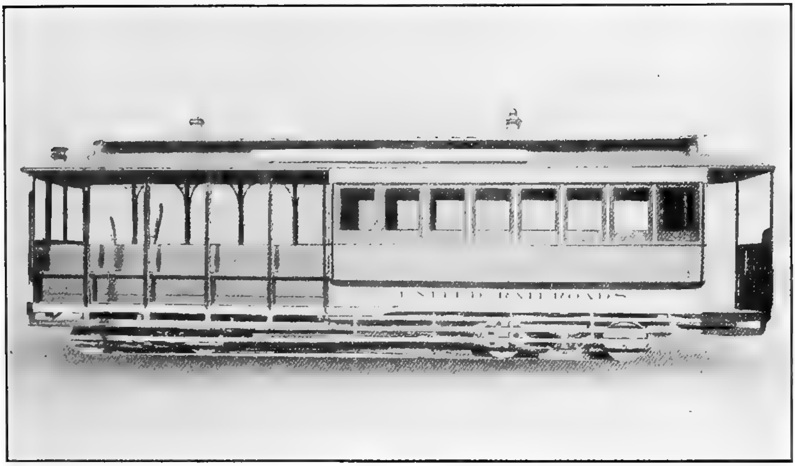
When the omnibuses became inadequate to serve the rapidly growing population, horse cars of various types were put into

TYPICAL EQUIPMENT, HORSE CAR PERIOD—1860-1870.
At the left—One-horse "Bob-tail" Car, City Railroad Co.
—Courtesy Gabriel Moulin.

service. These were limited by ordinance to 25 feet in length. In 1870 the Market, Omnibus, and North Beach & Mission lines used a two-horse car, seating about 20 passengers and operated by a conductor and driver. Most of the other lines used the "bob-tail" car, or the "balloon" car having a seating capacity of about 14, the latter being introduced on the steep Sutter Street grades on account of its lightness. The "balloon" car was provided with a patented device by which the car body could be turned on its truck, thereby eliminating turntables at terminals. These cars, as well as the "bob-tail" cars, were operated by a driver only, with a fare box at the forward end. The City Railway, which during the horse-car period had the reputation of keeping its cars better and cleaner than any other line, operated a one-horse car having a capacity of 14 seated and 5 standing passengers.

Just prior to the introduction of the horse car, the street railway cars were operated with a small steam dummy. The use of this dummy on Market Street was prohibited by ordinance after 1868.

During the early years of cable traction, trailers were used, hauled by a dummy car carrying the grip and brakes, it being thought that the dummy could adapt itself to sharp changes in



STANDARD MARKET STREET CABLE CAR—1906.
—United Railroads.

grade better than a longer and heavier car. It is curious evidence of erratic transit development in San Francisco that "trains" of this type are still operated on Pacific Avenue. Originally the dummies were intended to accommodate only the gripmen, but later were provided with seats. The dummies weighed from 2200 to 4800 lbs. each, and the trailers 2000 to 4000 lbs., with a seating capacity of usually about 16 for the trailers and 18 for the dummy car. Cars operated on Clay Street, the original cable line, were at first provided with clocks.

The Market Street Cable Railroad built in 1883 a new car, combining trailer and dummy. These composite cars weighed about 9,000 lbs., and carried one grip and wheel brakes on each of the two trucks. In 1893, single-end cars of the combination type—half open, half closed—weighing about 11,000 lbs. each, were built for this company, at a cost of $2,000 each. They used double trucks, 22-inch wheels, one pair of track brakes, and wheel brakes, the forward wheel brakes operated by a foot lever, and rear track brake by a hand lever; these could only be used with turntables or loops, and were the standard cable cars on the most important lines of the United Railroads up to the time of the fire.

After 1889 radical changes took place. The California Street Cable Company developed a car 35 feet long, weighing 11,200 lbs., and seating 34 passengers. It had double trucks with 22-inch wheels. Both wheel and track brakes were provided, but the latter was the most dependable one, using shoes of Oregon fir 20 inches long, which generally lasted about two weeks. This car used one grip

only, which was operated by levers from either end, interlinked. The operation of the double-end car eliminated the necessity for the expensive and cumbersome turntables formerly necessary to reverse cars at the end of the line.

The dummy and trailer type was used on many of the cable lines until 1889, but the "California" type or combination closed-body and open-end car became popular soon after it had been developed and was used widely in San Francisco during the cable period.

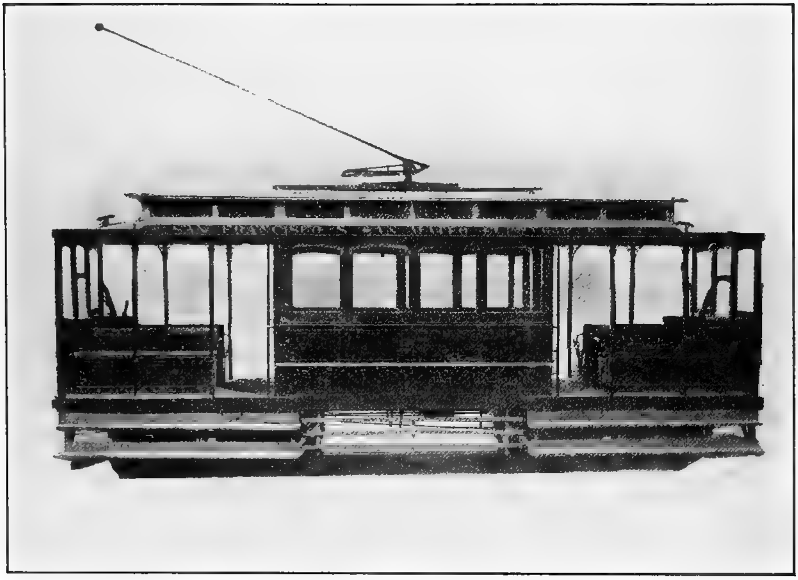
Until the electrification, the Presidio & Ferries Railroad retained the old system of dummy and trailer cars, the "train" being 45 feet in length.

The original Clay Street Hill cable line used a grip mounted upon fixed standards and operated by hand wheels (photo accompanying). On the Sutter Street line, the grip was operated by a lever and the cable taken at the side instead of the bottom of the grip as in the Clay Street cars. The cable could be dropped in this as well as in most of the later types by moving the lever to its extreme "open" position. On the California Street line, the side grip was also used, but provision made for dropping the cable by off-setting the track at proper points instead of mechanically casting off the cable as in other designs.

The Market Street cars used a grip quite similar to the California Street design. Howard Street cable cars used a bottom grip, which was closed by the pressure of movable rollers upon the outside of pivoted grip jaws. This same type was afterwards adopted on the Hyde Street line of the California Street Cable Railway, and is also now used on the Jackson and Sacramento lines of the United Railroads. On the other lines of the United Railroads, the side grip similar to the California Street design, is used.

When electric traction was introduced into San Francisco by the San Francisco & San Mateo Railway, the cars were modeled after the "California" type cable car, *i. e.*, with an open section at each end having longitudinal seats facing outward. The cars were 26 feet and 28 feet long, the shorter ones being single-truck, equipped with two 15 h.p. motors, and the longer ones double-truck with two 25 h.p. motors. Track and wheel brakes were installed at first, but the latter were finally discarded.

The Metropolitan Street Railway used combination cars 24 feet long, some having one and some two open ends. At first the body was mounted on radial trucks, but owing to insufficient braking power on steep hills, four-wheel trucks were substituted. The electrical equipment comprised two 25 h.p. motors.



EARLY TYPE OF ELECTRIC ROLLING STOCK.
San Francisco & San Mateo Electric Ry. Co.
—United Railroads.

There was no material change in the type of rolling stock until 1905. Power and seating capacity were increased, but the original "California" type was not departed from. In 1905 the United Railroads introduced the cars of the present 1300 class, much larger and heavier than those previously used. These are of the "combination" type, seating 42 passengers, but having cross seats in the open sections. The first departure from the open "California" type came in 1906-7, when the heavy all-closed "box cars" of the 1500 and 1550 classes were introduced. Then came the prepayment "box cars" of the 100 class. The present tendency is to return to an improved "California" type, such as the Geary Street or the United Railroads cars on order.

Franchises

Until 1870 all franchises for street railways were granted by the State Legislature. In the first Market Street grant the Company was required to grade and repair the street. Speed was limited to eight miles per hour. Other grants made during the sixties generally contained the following provisions:

Payment of an annual car license fee of $50 per car.
Fare limited to 6¼ cents.

City given power to reduce fares, but Company must not be deprived of a return of "24% per annum in net receipts on the capital actually paid in."

City given privilege to take over road any time within ten years at actual cost plus interest at ten per cent, but prohibited from transferring purchase privileges to other parties.

An Act of the Legislature in 1870 gave to cities power to grant franchises to horse railways for periods of 25 years. During the early seventies franchises were much the same as former grants, except that the maximum fare was fixed at ten cents.

In 1879, just prior to the adoption of a new State Constitution, practically all companies had their franchises extended for 50 years from that date. These grants are those expiring in 1929, as shown in Plate 22.

From 1879 to 1900, franchises which were granted in accordance with general laws of the State usually provided for: Term of grant, 50 years; rate of fare, five cents; rate of speed, eight miles per hour; car license, $50 per car per year.

In 1900 a new City Charter was adopted which declared for ultimate municipal ownership and forbade the granting of exclusive franchises. Including the amendments of 1902, the general franchise requirements provided for: Term of grant, 25 years; City regulation of service, rates and operation; City to receive from three to five per cent of the gross receipts; fixed property in the streets to revert to the City at the expiration of the franchise. Further amendment in 1907 extended the City's right of regulation over utilities and provided for their acquisition. By the amendments of 1910, franchises could be granted subject to the City's right to purchase at a fair value; minimum wages for employees were fixed at $3.00 per day of eight hours, all work to be completed within ten hours except in the case of City employees, upon whom no time limit was set; overtime at 1½ times the regular rate; failure to comply with any franchise conditions to work an immediate forfeiture without any power of the Board of Supervisors to relieve therefrom.

Financing

The first transportation systems—omnibus lines—were operated by individuals, and were not incorporated. The first incorporated company—the Market Street Railroad Company—as well as the companies formed later, from 1860-1880, issued stock only, which was assessed to cover the cost of construction of the road. Many of the early extensions were paid for out of earnings. The Market Street Cable Railway Company was the first

to issue bonds in addition to stock, and in 1883 the trust deed showed an issue of $3,000,000 (as well as $3,000,000 in stock) upon an investment in physical property of $1,600,000 as testified to by the president of the company. This caused considerable difficulty in selling the bonds. A sinking fund of $40,000 per year was provided, but the promoters evidently intended to ultimately refund the bonds since the accrued sinking fund in 20 years would fall far short of the amount necessary for redemption.

In 1893, the stock of the consolidating companies was taken over by the Market Street Railway Company, and its stock to the amount of $18,600,000 issued. This stock, which had originally sold for $25 per share in 1893, was later purchased by the "Baltimore Syndicate" at about par.

According to an official statement of the president of the new Company—$26,375,000 was paid "in cash for these properties subject to two or three bonded indebtednesses." At the time of the formation of the United Railroads in 1902, the total outstanding bonds of all underlying companies amounted to $13,091,000. Immediately upon the formation of the United Railroads securities were issued to the amount of $60,000,000 with an authorized capitalization of $75,275,000 excluding the underlying debt assumed.

About the time of the Market Street consolidation, the Geary Street Railroad issued bonds for $671,000, due in 1929, although its franchise expired in 1903. No sinking fund payments were required by the trust deed until 1911—8 years *after* the expiration of the franchise.

FULL TEXT OF CHARTER AMENDMENT No. 34

Adopted by Board of Supervisors November 7, 1912

Describing and setting forth a proposal to the qualified electors of the City and County of San Francisco, State of California, to amend the Charter of said City and County by amending Section 12 of Chapter 1 and Sections 5, 6, and 7 of Chapter 2 of Article 2 thereof and by repealing Sections 7a, 7b and 7c of Chapter 2 of Article 3 thereof, relating to the granting of franchises for street railways and other public utilities, and providing for the surrender and resettlement of franchises and rights now held by persons, companies or corporations operating street railways or other public utilities within the limits of said City and County.

The Board of Supervisors of the City and County of San Francisco hereby submits to the qualified electors of said City and County at a special election to be held on the tenth day of December, 1912, a proposal to amend Article 2 and Article 3 of said Charter as follows:

That Section 12 of Chapter I of Article II be amended to read as follows:

Section 12. When a bill is put upon its final passage in the Board and fails to pass, and a motion is made to reconsider, the vote upon such motion shall not be acted upon before the expiration of twenty-four hours after adjournment. No bill for the grant of any franchise shall be put upon its final passage within thirty days after its introduction, and no franchise shall be renewed before one year prior to its expiration, except as otherwise provided in Section 7 of Chapter II of this Article. Every ordinance shall, after amendment, be laid over one week before its final passage.

That Section 5 of Chapter II of Article II be amended to read as follows:

Section 5. No exclusive franchise or privilege for the construction or operation of any public utility shall ever be granted unless said franchise shall provide for the extension of such utility as public need requires and for the purchase of such franchise and the property of such utility at the option of the City and County of San Francisco, as provided in Sections 6 and 7 of this Chapter.

NEW FRANCHISES

That Section 6 of Chapter II of Article II be amended to read as follows:

Section 6. The Board of Supervisors shall have power, subject to the referendum as elsewhere provided in this Charter, and subject to the terms of a general ordinance hereinafter provided for and to be passed by the Board of Supervisors and ratified by the people, to grant franchises for the construction, maintenance and operation of street railways, gas works, electric works, water works, telephone systems and other public utilities upon, or over, or under, or across the streets and public places of the City and County of San Francisco upon the folowing conditions and in the following manner:

1. No franchise shall be granted for a street railway upon any street or part of a street reserved for a boulevard, except for the purpose of crossing the same.

2. No franchise granted under the authority of this section shall run for a period longer than twenty-five (25) years, except that if at the expiration of the original period of the grant the investment under such franchise shall not have been fully amortized and the City shall not exercise its option to purchase the property, the grantee shall be entitled to a renewal or renewals not exceeding in the aggregate fifteen (15) years. Every franchise so granted shall be subject to the right of the City and County to recall such franchise prior to the termination thereof or of any renewal thereof upon purchasing or finding a purchaser for such franchise and the property constructed or used in connection therewith upon terms and in a manner calculated to render the legitimate and judicious investment of private capital under such franchise safe and remunerative, such terms and manner to be prescribed by a general ordinance hereafter to be passed by the Board of Supervisors and ratified by the people of the City and County of San Francisco. Such franchise may also provide that at the expiration thereof, the City and County shall purchase or find a purchaser for the property constructed or used in connection therewith, upon terms and conditions to be prescribed in such franchise or by such general ordinance referred to in the last preceding sentence and as may be in force and effect at the time of the granting of such franchise. In case any franchise hereafter granted by the City and County is recalled prior to its expiration, the price to be paid therefor in addition to the price of the property constructed or used thereunder is hereby fixed at the sum of one dollar, but this shall not be construed as forbidding the City and County to pay a bonus on account of the cost of developing the business or on account of operating deficits incurred within ten (10) years subsequent to the commencement of operation of any such utility and not made up, in addition to a fair return upon investment, prior

to the recall of such franchise. But in case the property of any utility is not purchased until the expiration of such franchise, nothing whatever shall be paid for such franchise or as such bonus. Provision shall be made in such franchise, or in such general ordinance above referred to, for the amortization out of earnings of all or a part of the purchase price of the property prior to the expiration of the franchise, and, except for the bonus above mentioned, the entire price to be paid for the property when acquired by the City shall not exceed the fair value, at the time of such purchase, of the tangible property so acquired less the amount amortized at the time of such purchase.

3. A franchise may be granted under this section either upon application to the Board of Supervisors or upon proceedings initiated by resolution of said Board declaring that public convenience and necessity require the grant of such franchise.

4. Upon application being made to the Board for any such franchise, it shall by resolution determine whether such franchise or any part thereof should be granted, and at said time shall determine on what conditions the same shall be granted additional to the conditions expressly provided in this Charter or in any general ordinances then in force relative to such matters. After such determination, it shall cause notice of such application and resolution to be advertised in the official newspaper of the City and County for ten (10) consecutive days. Such advertisement must be completed not less than twenty (20) nor more than thirty (30) days before any further action is taken by the Board on such application. The advertisement must state the character of the franchise sought, the term of its proposed continuance, and the route to be traversed or the district to be served by such utility, as the case may be; that sealed bids will be received up to a certain hour on a day to be named in the advertisement; and a further statement that no bids will be received of a stated amount, but that all bids must be for the payment to the City and County in lawful money of the United States of a stated percentage of the gross annual receipts of the person, company or corporation to whom the franchise may be awarded, arising from its use, operation, enjoyment or possession; provided that all costs of printing, publication and advertising shall be borne by the applicant or applicants.

Every bidder shall file with his bid a bond executed to the City and County, with at least two good and sufficient sureties, to be approved by the Mayor, in a penal sum prescribed by the Supervisors, and set forth in such advertisement, conditioned that such bidder will accept such franchise if awarded to him and will well and truly observe, fulfill and perform each and all of the condi-

tions, terms and obligations of the franchise for which said application was made in case the same shall be awarded to him, and that in case of the breach of any of the conditions of such bond, the whole amount of the penal sum therein named shall be taken to be liquidated damages, and that as such, shall be recoverable from the principal and surety on such bond.

At the next regular session after the expiration of the time stated in such advertisement up to which such bids will be received, the Board shall open such bids, and shall take into consideration the award of such franchise. The Board may reject any and all bids, and may refuse to grant the franchise applied for or any part thereof. If the Board decides to grant the franchise, it shall, within ten (10) days after the opening of such bids, award the franchise to the highest bidder and introduce an ordinance making such grant. At least thirty (30) days shall intervene between the introduction and the final passage of such ordinance, and such ordinance shall require upon final passage the concurrence of three-fourths of the members of the Board and the approval of the Mayor; provided, that if the Mayor fails or refuses to approve such ordinance within the time allowed for his approval or veto of ordinances and resolutions under the provisions of this Charter, such grant may be repassed by a concurrent vote of five-sixths of the members of the Board, and shall thereupon become effective as if the Mayor had signed it, subject only to the provisions contained elsewhere in this Charter relating to the referendum.

Except as in this section otherwise provided, bidding for a franchise shall be in accordance with the provisions of this Charter in relation to bids made to the Board of Public Works, or such official or body then performing the duties now performed by said Board, so far as such provisions may be applicable. If any bid be accepted, the franchise must be granted upon the express condition that such franchise shall be exercised subject to all the provisions of the Constitution of the State of California and of this Charter and of any general ordinances then in force in the City and County of San Francisco relative to such franchises or operation thereunder; and further upon the express condition that the percentum of the gross receipts of such utility payable to the City and County shall be paid into the Municipal Treasury on or before the twentieth (20th) day of the next ensuing month after such gross receipts shall have been earned. At the time such percentages are due the grantee shall file with the Clerk of the Board of Supervisors a sworn statement in general detail of the gross receipts upon which such percentages are payable, and in addition to all other powers of examination of public utility accounts elsewhere

in this Charter conferred upon the City and County or any department or officer thereof, the Board of Supervisors shall have authority, by its Finance Committee or other designated agent, to examine the accounts of such grantee for the purpose of verifying such statements of gross receipts. Any substantial failure on the part of the grantee of any franchise granted under this Charter, not due to causes beyond his control, or any refusal of such grantee to comply with the conditions of such franchise shall work an immediate forfeiture of the grant, and of all fixed property constructed or acquired thereunder in the streets or public places of the City and County of San Francisco.

5. In case the proceedings for the grant of any franchise are initiated by resolution of the Board of Supervisors rather than by an application for such franchise the procedure to be followed in making such grant shall be the same as above provided in Subdivision 4 of this section, so far as such procedure can be applied thereto.

6. In granting any franchise under this section the Board of Supervisors shall stipulate as a condition of such grant that eight hours shall be the maximum hours of labor in any calendar day for the employees of the grantee or its successors engaged in the construction, maintenance and operation of the utility covered by such grant; provided that such eight (8) hours' work shall be completed within ten (10) hours except in the case of the operating force of any street railway, in which case the working day shall be completed within thirteen (13) hours; and provided further, that nothing in this section shall be construed to prohibit overtime employment,* wages for such overtime to be paid at one and one-half times the regular rate of wages proportionate to each hour of such extra service.

7. The Board of Supervisors shall prescribe, in any ordinance for the grant of a franchise, the security to be exacted for the performance of the conditions of such franchise and the penalties for a breach thereof.

8. No franchise granted hereunder shall become effective as against the City and County until the same has been accepted in writing by the grantee thereof.

9. No franchise hereafter granted by the City and County of San Francisco, and no fixed property constructed or acquired thereunder in the streets or public places of said City and County, shall be assigned, leased, alienated or transferred in any manner whatsoever by the grantee thereof, his successors or assigns, except by mortgage or deed of trust duly executed in accordance with the laws of the State of California, unless such assignment, lease, alien-

*The remainder of this sentence may be omitted, if desired, in case Amendment 34 is resubmitted for referendum.—(B. J. A.)

ation or transfer shall have been consented to by ordinance, and the passage of any such ordinance shall be governed by the same procedure and shall require the same approval as the ordinance originally granting such franchise. Any violations of the provisions of this paragraph shall result in the immediate forfeiture to the City and County of such franchise and property.

RESETTLEMENT OR ADJUSTMENT FRANCHISES

That Section 7 of Chapter II of Article II be amended to read as follows:

Section 7. In order to further the established policy of the City and County of San Francisco gradually to acquire and ultimately to own its public utilities, the Board of Supervisors may negotiate a general resettlement of the franchise rights and obligations of any person, company or corporation actually operating a public utility in said City and County at the time this amendment becomes effective, upon the following terms and conditions:

1. Any such resettlement franchise shall provide for the surrender by the grantee thereof of all franchises or rights claimed by such grantee for the occupation of the streets or public places of said City and County at the time of such resettlement, and the acceptance, in lieu of such franchises and rights so surrendered, of the rights and privileges granted by such resettlement franchise as the sole franchise for the continued operation of such utility within the limits of said City and County.

2. Any such resettlement franchise shall provide that the City and County may at any time on six (6) months' notice purchase such franchise and the property, real and personal, actually used and useful and, in the discretion of the City and County, such other property of the grantee as may be prospectively useful in the operation of such utility, upon payment therefor of an amount, and in a manner, to be determined as shall be prescribed by such resettlement franchise.

3. Any such resettlement franchise shall make provision for the extension and development of the utility operated thereunder in accordance with the needs of said City and County and the inhabitants thereof as such needs may from time to time arise, and all extensions and improvements of such utility subsequent to the date of such resettlement franchise shall be subject to the terms thereof.

4. No such resettlement franchise shall in any case confer upon the grantee thereof the right to occupy the streets or public

places of said City and County for a longer period than twenty (20) years from the date thereof unless effective provision is made therein for the gradual reduction of the purchase price by means of an amortization or other fund accumulated out of earnings, sufficient to retire, within such period of twenty (20) years, all elements of intangible value included in the purchase price as defined in subdivision 6 of this section.

5. No such resettlement franchise shall in any case confer upon the grantee thereof the right to occupy the streets and public places of said City and County for more than forty (40) years from the date thereof unless effective provision is contained therein for retiring within such period of forty (40) years, in addition to the intangible value referred to in the preceding paragraph, at least all that portion of the purchase price representing fixed structures in the streets and public places and all lands and landed rights* actually used and useful, at the end of such period of forty (40) years, in the operation of such utility and included in the original appraisal at the date of such resettlement franchise or added under the terms thereof within twenty (20) years after such date.

6. Any such resettlement franchise shall provide a fixed agreed price for the property of such grantee based upon an appraisal at a date named therein, which shall constitute the basic price for purchase by the City and County. For determining the actual purchase price at which the City and County may take over the property at any given time, additions to and subtractions from such basic price shall be made as follows:

There shall be added the cost from time to time of improvements, additions, betterments and extensions properly chargeable to capital account, such cost to be ascertained in a manner to be determined by such franchise.

There shall be subtracted from such basic price the original appraised value of any property permanently alienated by the grantee and not replaced prior to the time of such purchase.

There shall also be subtracted from such basic price the amount of depreciation, if any, in the value of the tangible property of such utility, other than land, which may have accrued through neglected maintenance subsequent to the date of the original appraisal and prior to the date of such purchase, the amount of any such depreciation, if not agreed upon by the parties, to be determined, upon application of the City and County, by the California Railroad Commission or by arbitration, as may be set forth in such resettlement franchise.

*See Paragraph 11, Page 379, under Resettlement Franchises.

There shall also be subtracted from such basic price the amount of any payments made to the grantee prior to the time of said purchase applicable to reduction of capital value or purchase price and the amount of any amortization or other fund in the hands of the grantee, or payable to the grantee, accumulated out of earnings for the purpose of effecting such reduction.

7. Any such resettlement franchise shall provide for the investment of the amortization or purchase fund in the securities of such utility, or of other local utilities operated under similar franchises, or in the bonds of the City and County, to the end that such fund shall be invested in such a way as to accumulate as rapidly as shall be consistent with safe and conservative management, and in such a manner as to minimize the cost of securing additional capital for the extension and improvement of the plant of such utility.

8. Any such resettlement franchise shall provide for adequate continuous control by the City and County over the construction, accounts, equipment and service of such utility during the entire life of such franchise, and especially it shall provide for the maintenance of the property of such utility at the highest practicable standard of operating efficiency throughout the life of such franchise.

9. Any such resettlement franchise may provide that the City and County, in taking over the property of such utility at any time, may assume the bonds then outstanding against such utility not exceeding in aggregate amount the appraised value of the tangible property acquired at the time of such purchase, and in such case the par value of the bonds so assumed shall be deducted from the purchase price as determined in accordance with such franchise. The bonds so assumed shall no longer, after such purchase, be a lien upon the franchise or property of the utility as such, but may be secured by the general credit of the City and County, or as a lien upon a fixed percentage or amount of the gross earnings of such utility, or otherwise, as may be provided in such resettlement franchise.

10. Any such resettlement franchise may provide as a next charge after operating expenses and maintenance, including proper provision for current depreciation, an allowance to the owner of such utility of an annual return upon the capital value of such utility represented in the purchase price as determined from time to time in the manner prescribed in such franchise. It may provide further for a division of net profits, or for a bonus for skillful operation, or for other means calculated to enlist the motive of the owners or operators of such utility for the rendition

of adequate, safe and convenient service and for the efficient and economical operation of such utility.

11. Any such resettlement franchise may provide that any share of the net profits payable to the City and County under the terms of such franchise, or any other income derived by the City and County from the utility operated under such franchise, shall be put into the amortization or purchase fund in addition to the regular contributions to such fund out of earnings, in order to hasten as much as possible the reduction of the purchase price or capital value of such utility.

12. Any such resettlement franchise shall provide that eight (8) hours shall be the maximum hours of labor in any calendar day for the employees engaged in the construction, operation and maintenance of the utility under such franchise; provided, that such eight (8) hours' work shall be completed within ten (10) hours, except in the case of the operating force of any street railway, in which case the working day shall be completed within thirteen (13) hours, and provided further, that nothing in this paragraph shall be construed to prohibit overtime employment,* wages for such overtime to be paid at one and one-half times the regular rate of wages proportionate to each hour of such extra service.

13. No such resettlement franchise shall include more than one kind of public utility in the same contract or ordinance, and no such contract or ordinance shall go into effect until it shall have been submitted to the electors of the City and County of San Francisco and shall have received the approval of the majority of those voting thereon.

14. Any such resettlement franchise shall be introduced in the form of an ordinance and laid over for at least thirty (30) days prior to being passed to print, during which period public hearings shall be held, and shall remain before the Board for sixty (60) days thereafter before its final passage, and shall be passed by a two-thirds vote of the members of the Board of Supervisors and shall be signed by the Mayor, or in case of his veto of such franchise, shall be repassed by a five-sixths vote of the members of such Board in its final form and published not less than sixty (60) days prior to the date of the election at which it is to be voted on by the people. It shall be the duty of the Board of Supervisors to give public hearings on such proposed resettlement franchise prior to its final passage, and immediately after such final passage, and within seven (7) days thereof, to cause such franchise to be printed in convenient pamphlet form

*The remainder of this sentence may be omitted, if desired, in case Amendment 34 is resubmitted for referendum.—(B. J. A.)

for public distribution, and to publish daily thereafter up to the date of such election in the official paper of the City and County notice to the effect that any person may secure a printed copy of such franchise free of charge by application therefor in person or by mail to the Clerk of the Board of Supervisors; provided, that all costs of printing, publication and advertising shall be borne by the applicant or applicants.

15. Any such resettlement franchise may provide that the City and County may at its option designate a licensee who shall have the same right to take over the franchise and property of such utility upon notice from the City and County as the City and County itself has, except that such licensee may be required to pay a bonus to the holder of the franchise, the amount of which shall be fixed in such resettlement franchise, in addition to the price the City and County would have to pay if it took the property over for itself at that time, but the designation of such licensee shall be by ordinance only, and no such ordinance shall go into effect until it has been submitted to the electors of the City and County and approved by the majority voting thereon.

16. Any such resettlement franchise may provide that upon the annexation to or consolidation with the City and County of San Francisco of any territory not now included in said City and County, any franchises or rights to operate such utility held or claimed by the grantee of such resettlement franchise in or for all or any portion of such annexed or consolidated territory shall thereupon be surrendered to the said City and County of San Francisco and that the privileges and obligations of such resettlement franchise shall thereupon automatically extend to such additional territory or any part thereof and an appraisal and valuation of the franchises and property used and useful or, in the discretion of said City and County, prospectively useful in the supply of such utility to the area so annexed to or consolidated with said City and County, and not included in the capital value or purchase price already fixed in such resettlement franchise, shall be made in a manner to be prescribed in such franchise to the end that the option of the City and County to buy such utility and to require extensions and betterments thereof, and all of the rights and obligations acquired, assumed, granted or imposed by or upon either the City and County or the grantee by such resettlement franchise shall extend to all the territory now or hereafter included in said City and County so far as such territory may be occupied by such utility; or such franchise may provide for the extension of the terms thereof in the manner just described to

such annexed or consolidated territory only as shall be contiguous by land to the City and County of San Francisco as now constituted.

17. In the negotiation, framing and passage of any such resettlement franchise the Board of Supervisors shall not be subject to or bound by the terms and conditions relating to franchise grants contained in subdivisions 2 to 5, inclusive, of section 6 of this chapter, but may, in its discretion, impose terms and conditions in addition to and different from, but not inconsistent with, the provisions of this section.

18. Any such resettlement franchise may be amended from time to time by ordinance passed by the Board of Supervisors, approved by the Mayor and ratified by the people in the manner herein prescribed for the passage of such franchise in the first instance; provided, that any such amendment shall not be effective unless accepted by the grantee of such franchise and that such amendment shall in no respect contravene the provisions of this section.

That sections 7a, 7b and 7c of Chapter II of Article III are hereby repealed.

Ordered submitted—Board of Supervisors, San Francisco, November 7, 1912.

Ayes: Supervisors Bancroft, Caglieri, G. E. Gallagher, Giannini, Hilmer, Hocks, Jennings, Koshland, Mauzy, McLeran, Murdock, Murphy, Payot, Vogelsang.

Absent: Supervisors A. J. Gallagher, Hayden, McCarthy, Nolan.

(Signed) J. S. DUNNIGAN, Clerk.

OPERATING PLANS FOR LOWER MARKET STREET

(See Key Sheet Figure 36, Page 139)

Present Plan. Figure 36 has been prepared in order that comparison might be made between the present plan of stops and the two alternative plans presented herein, *i. e.,* disregarding certain trial improvements introduced by the traffic force. The position of all stops are shown as in Plans A and B, and the reasons for the elimination of the unnecessary ones will become more apparent after a study of the revised schemes. For example, both near-side and far-side stops are made at Sixth, Fifth, Fourth, and Third Streets, and also an intermediate stop in the Lotta's Fountain triangle. In this present scheme, the average distance between stops is 368 feet, which is 19 per cent less than the recommended Plan A, and 24 per cent less than tentative Plan B.

Plan A. (Plate 10.) *In-bound Stops.* At present, stops are made at Fifth Street, west side; Fifth Street, east side, and intersection stop at Eddy Street. One of these, the middle stop, has been eliminated, and the safety intersection stop made use of as a loading stop, assisted by a single-car safety station located as close to the special work as possible so as to permit eastbound vehicle traffic from Powell Street to have ample passageway west of the station.

In-bound stations, as a rule, are not as necessary as out-bound stations, for the reason that in-bound passengers immediately disperse to the sidewalks, and no waiting at the station is necessary. However, in the case of Market Street, a special condition arises owing to the location of the Ferry building. Below Second Street, it is found from observations that the vast majority of ferry patrons walk, but from this point westward the street cars are patronized more and more, the heaviest in-bound loading points during the rush hours being at Third Street and Powell Street. Consequently, an in-bound station has been located at the latter point, and the Third Street in-bound station lengthened to permit of two-car crossings.

At Fourth Street, the traffic rules would ordinarily dictate that Fourth-Stockton Street traffic should cross Market Street at right angles. However, on account of the offset in these streets, it is desirable to allow this traffic to parallel the Ellis Street tracks, so that the in-bound stop may be located as shown. East of Kearny Street tandem stops must be provided for, the first car reaching the corner to take the forward berth.

At First Street the "near side" rule is departed from in order to secure a better distribution of stops and clear the First Street thoroughfare for vehicle traffic from Battery Street, which, with First Street, is an extremely important thoroughfare.

From First Street to the Ferry, stops are shown only at *alternate* streets. This is for the reason that these blocks are short—only 275 feet. And it is believed that this part of the in-bound run should be freed from unnecessary stops in order to deliver passengers as promptly as possible at the Ferry. Observations show that in-bound traffic below Second Street is extremely light, so that the elimination of these intervening stops will not work any serious inconvenience, considering the interests of the vast majority of in-bound passengers. In any event the maximum distance Ferry-bound passengers from Fremont and Main Streets have to walk to reach a car stop is about 220 feet.

If it should appear desirable to continue "flag" stops at every in-bound crossing during the morning hours, it will still be desirable to adhere to the limited stop scheme shown hereon for the afternoon rush, at least after

4 o'clock, when approximately six times the number of passengers travel Ferry-bound than during the hours of morning and early afternoon. This change, however, may result in some confusion, and it is believed to be more desirable to omit the extra stops altogether. Plan A introduces an average distance between stops that is less than three-fourths the length of the block between Jones Street and City Hall Square, which is approximately 1,000 feet.

Out-bound Stops. Starting from the Ferry, out-bound, it is believed that the Sacramento Street stop is in a large measure unwarranted, the intersection being so near the Ferry terminal. The average length of walk from the middle of the block to the first out-bound stop is not excessive—370 feet. However, a tentative stop has been shown.

The safety station in the plaza opposite Bush-Battery Streets may be retained, as it does not interfere with traffic, although it is not in a very effective position for tandem stops.

The First Street line should "dead-end" at Market Street, and not cross the throat tracks, at least during rush hours. This provision need not necessarily invalidate the status of the franchise of this line.

At the Sutter Street branch-off, Sutter Street cars should berth off of Market Street.

At Second Street, the heavy out-bound loading begins and the "near side" stop is shown in order to permit proper vehicle crossings and to avoid an exceedingly short run to the next stop. The walking distance to the Second Street stop from the intersection of Post and Montgomery Streets is practically the same as to the next stop west.

The present station in front of the Crocker National bank must necessarily be abandoned with four-track operation, although the tandem stop may be located in practically the same position.

At Lotta's Fountain, Third-Kearny Streets, the station must be enlarged for a two-car stop. This point is the heaviest loading point along Market Street, exceeding even the Ferry on the out-bound trips. Here, two-car crossings must be rigidly adhered to on signal, and railway inspectors should co-operate with the traffic squad in securing prompt transits. It may even be necessary to dispatch cars from the in-bound and out-bound stations, respectively, at Third Street, *arbitrarily* on signal, as in rapid transit subway service. This is the most congested intersection in the city, and it may be desirable to install a railway dispatcher in a small tower at the apex of Market and Geary Streets, who, relaying the traffic signals, will control car transits by means of semaphore signals, as is done in other cities.

Owing to the excessive obstruction of pedestrian traffic along the north side of Market Street, it is undesirable to stop the Third-Kearny Street cars in the triangle opposite Lotta's Fountain. In this position cars completely interrupt the flow along both Market Street and Geary Street walkways. The cross-town cars should, therefore, make the run from Third Street to Kearny Street without stopping. And a north-bound stop opposite the Chronicle building will be more desirable than to attempt an additional stop in the triangle. To secure this result, relay traffic signals must be put into effect so as to control the Market Street and Geary Street lines simultaneously. If this is done the interruption to the Market Street tracks will be far less serious, as the in-bound Geary Street cars may cross to their position on the outer tracks while loading of Market Street cars is taking place at the Lotta's Fountain station.

The present safety station opposite Stockton Street should be moved to the east side of the crossing, as shown. Its location is entirely incorrect, being too near the Emporium station and on the far-side of the intersection. The *near-side safety stop* on the Ellis Street tracks should be used for loading purposes, and the far-side stop eliminated. As Fourth Street is also a heavy passenger loading point, a two-car station is desirable.

By reason of this change, the station opposite Grant Avenue should also be removed to the *near-side* position and extended to accommodate two cars,

in order to secure a more even spacing of stops. In this position, the Grant Avenue station will be of additional value in drawing traffic away from the Lotta's Fountain station and thereby reducing congestion there. Situated approximately midway between the Call and Phelan office buildings, it will be able to do this more effectively than in the present far-side position.

A difficult problem exists in the two out-bound stations opposite Powell Street. First, the westerly station is unfortunately located directly in the line of all street traffic between Powell and Fifth Streets. Second, the stop here practically amounts to a far-side stop, whereas the near-side safety stop opposite the Flood and Emporium buildings should be utilized for loading purposes at this intersection. Third, it may be desirable in the near future after an adequate Mission Street terminal at the Ferry has relieved the Fifth Street stub terminal to route some of the out-bound cars via Mission Street, returning to Market Street at Fifth Street, in which event this station will be unavailable for loading and transfer purposes. After much study, it appears desirable to move this station westerly to a point approximately midway between Mason and Fifth Streets, where it will be in a position to receive this Mission Street loop loading. In the position shown, the Mason Street station will require a walk of only 160 feet from the Fifth Street building line. The Flood-Emporium station may then be moved westerly to the Eddy Street branch-off, and it should be extended to accommodate two cars. In this position, the station will be but 85 feet distant from the Powell Street building line, and will consequently prove more convenient for transfer purposes than at present. However, *until the merits of this change become apparent,* the present westerly station may be retained and is consequently indicated hereon as "tentative."

Plan B. In the alternative Plan B, Figure 36, the station stops westerly from Geary Street are indicated in the same position as in the previous Plan A. Commencing at the Chronicle building, the present United Railroads tracks are shown diverted to the east side of the street, so that no car interferences with the Geary Street line will be encountered; similarly at Sutter Street. In all station locations, except at Davis-Beale Streets, the spread of the west side tracks around the safety station occurs opposite the triangular plazas, so as not to reduce the width of roadway. Although eight cars are shown at these points, it is not likely that such a condition will occur except very infrequently.

On this plan, the protruding corner of Sacramento Street at The Embarcadero has been receded, in order to provide additional roadway area, much needed for both car and vehicle traffic. It will be observed that in this position Spear Street may now be used to much greater advantage than at present, in order to relieve traffic across the loop throat.

In all cases free-way for vehicle traffic has been preserved in accordance with established traffic rules.

DIGEST OF SPECIFICATIONS FOR THE MUNICIPAL RAILWAY CARS

General Dimensions

Length over end panels	32 ft. 5 in.
Length over bumpers	47 ft. 1 in.
Width over belt rail	8 ft. 6 in.
Width over guard rail	8 ft. 6 in.
Height, top of rail to top of trolley board	11 ft. 9 in.
Center to center of posts	2 ft. 9⅞ in.
Truck centers	20 ft. 10 in.
Diameter of wheels	34 in.
Wheel base	4 ft. 10 in.
Seating capacity, car body	44

Framing

Body Framing—To be of the straight side type, and the steel side panel, with a bottom side sill angle and top belt rail angle to be riveted together to form a plate girder side sill. The steel side panels shall be No. 8 U. S. Gauge.

Body, side and bulkhead posts to be of Eastern ash.

Bottom Framing—To be of all-steel construction, supplemented where necessary by pine nailing strips.

Body Bolsters—To be of cast steel I-beam section not less than 10″ in width and 9″ in depth at the center. Bearing on side sills to be planed surface at least 14″ wide.

Flooring—13/16″x2½″ T & G maple in one layer, laid lengthwise. The car floor to slope downwards 2″ from the bolsters to the end sills. Floor mat strips of hard maple to be provided in the aisles. Floor to receive one coat of boiled linseed oil. Platform floor to be 11″ below the car body floor at the end sill and of the same character as body floor.

Platform Framing—To be of all-steel construction with the main side-platform knees of 6″ 13 lb. channels or equal, and the intermediate framing designed for a stress not exceeding 12,500 lbs. per square inch, with maximum load. The bumper to be of 5″ 11½ lb. channel having a radius of about 6′ 9″ at the center.

Roof Framing—The car roof to be of the plain arch type, continuous from end to end of the car. Roof to be supported by continuous metal carlins at each post bolted to wood carlins, and by two intermediate wood carlins between metal carlins. Roof framing to be covered with poplar boards, 2½″x⅜″ covered with National Prepared Roofing Canvas, "FF" quality and in one width on body roof.

Vestibules—To be of the round-end clam-shell type. Each vestibule above the belt rail shall comprise three drop double-sash. Inside and outside of dash below window rail to be panelled with No. 16 U. S. Gauge sheet steel. Vestibule roof carlins to be ⅞″x1⅛″ elm or ash, with one iron re-inforced carlin in each vestibule. Inside of finished rail of vestibule beneath sash to be re-inforced with a ⅜″x3½″ iron brace in one piece attached to corner and intermediate posts, to which brackets for controller, handbrake and other apparatus are to be bolted.

Vestibule to be of the P. A. Y. E. type, and provided with a 1¼″ iron pipe rail arranged to accommodate the conductor and the fare box, and allowing a 26½″ passageway between corner post and step stanchion. On the controller side of the platform, folding iron pantagraph gate to be installed

and sliding gate 4′ high provided on the hand-brake side, closing against the car body corner post and operated by the motorman from his position. Gate opening to be not less than 30″ in width.

Doors—Closed central portion of the car body to be provided with single-leaf sliding doors, having a clear opening of 30″.

Sash—Body to have 11 window openings on each side, those in the central portion only being fitted with double sash, the lower sash arranged to raise vertically to the level of the bottom of the top sash.

Curtains—All side window openings of the car body shall be provided with Pantasote curtains, Pattern J, Color 86, mounted on Rex metal spring rollers. Curtain fixtures to be Curtain Supply Company's ring fixture No. 88. One curtain 30″ in width shall be installed in each vestibule for the protection of the motorman.

Seats—Cross seats shall be Hale & Kilburn's reversible walk-over type, 199-A, with spring cushions and backs upholstered in rattan, flat pressed steel end plates and pressed steel pedestals. Cross seats shall have 17″x34″ cushions and shall measure not more than 37⅛″ over end plates so that the aisle between cross-seats shall not be less than 24″ in its narrowest part. The two longitudinal seats shall be upholstered in rattan. One seat of slat construction at least 5′ 6″ long, arranged to raise up to the ceiling of the vestibule, to be installed on each platform.

Inside Finish—Where of wood shall be of selected cherry, finished dull. Arch ceiling to be of 3/16″ Agasote in three sections.

Fare Registration—Each car to be equipped with one Johnson fare box and with one Sterling Meaker No. 16 double register, operated by removable foot pedal from either platform.

Signs—Four illuminated destination signs of the Electric Service Supplies Company type shall be furnished on each car. One to be installed in each top vestibule center sash, and one in each middle top sash in the closed compartment. One route sign box, taking 12″ ground glass slides on two sides shall be installed over each platform on the sliding gate side.

Ventilation—The closed portion of the car shall be equipped with four exhaust ventilators of the Wilson make or equal, each having a capacity under normal operating conditions of 3,000 cubic feet per hour. Four intakes about 4″x8″ to be provided in the floor of the closed compartment.

Miscellaneous Fixtures—Four galvanized iron sand boxes fitted with an air sanding device with each car. One buzzer on each end of the car operated by push buttons located on each side post. Each end of the car shall be fitted with an "Eclipse Life Guard" fender. Five porcelain enameled iron hand straps of the "R. I. C. O." type over each longtitudinal seat.

One Crouse-Hinds Type "W" headlight installed in the center of the dash at each end.

Grab Handles—Of enameled iron placed on the inside face of all body corner posts, on the vestibule and body corner posts, at the entrance of the platform, and on the gate post inside of the vestibule.

Steps—Two folding steps of the Chicago Railway Company's design or equal to be provided on each side of the car. Steps to be at least 9″ in width, provided with at least a 4″ universal safety tread, and placed 14″ below the platform floor.

Brakes—Each car shall be equipped with a complete brake rigging for air and hand brakes, each system complete in itself. Hand brake to be of the Ackley no-staff type and so arranged that with 75 lbs. pressure on the brake wheel, the same braking power is provided as with air brakes.

Lighting—All lamps to be Tantalum, 115 V., series-burning railway lamps, having an efficiency of not less than 2.4 watts per candle. All lighting wires to be run in iron armored conduits.

Wiring—All wiring and electrical apparatus to be installed so as to conform to the rules and requirements of the National Board of Fire Underwriters. All wiring to be in thoroughly grounded iron-armored conduit. All wiring, conduit, fittings and circuits, after installation, shall be tested to full normal voltage.

Paint—Exposed rough steel to be painted as follows: Thoroughly cleaned; primed with special steel primer; puttied and plastered; one coat of lead color; three coats of rough stuff, rubbed with pumice; three coats of color; one coat of varnish, rubbed; two coats of heavy body wearing varnish. Smooth steel (exposed) to be cleaned with emery and washed with benzine, with same finish as for rough steel.

Motor Equipment

Four direct-current, inter-pole railway motors to be provided in each car.

Service Conditions—Motors are intended for the operation of cars weighing about 21 tons each exclusive of motors and control on grades up to 12%; maximum speed on level tangent, 25 m. p. h., at 600 volts; schedule speed desired about 9 m. p. h., with an average of about 8 stops of 6 seconds duration each per mile. Gearing to be single reduction, with pinion having not less than 15 teeth.

Capacity—Each motor to develop not less than 50 h. p. at 500 volts D. C. at the car axle, with a temperature rise above the surrounding air of 70° C. at the commutator, and 75° C. at any other part after one hour's continuous run at 500 volts on a stand test with motor covers removed and with natural ventilation. Motors to be designed to operate normally and continuously at 600 volts and safely for short periods at voltages up to and including 750 volts. Efficiency of the motors with gears at 50 h. p., 600 volts, shall not be less than 83.5%, and the speed shall not exceed 600 r. p. m. under these conditions. Armatures shall withstand without mechanical injury a speed of three times the normal under the above load conditions.

Clearances—Motors shall be designed with sufficient clearance for mounting on axles with 48″ between hubs. With motor at its lowest position, clearance above rail shall not be less than 4″ with a 34″ wheel. Height of top of shell above center of axle shall not exceed 13¼″.

Miscellaneous—Motor including axle collar, bearing housings and pinion, to weigh not more than 2,400 lbs. Shell to be of cast steel of the unsplit box type, approximately cylindrical or octagonal in shape, with armature bearings encased in solid housing. Field coils of the mummified type, preferably strap wound. Steel gears shall be of the solid type and pinions of forged steel, both having cut teeth, with a wearing face of not less than 5″ Gear case to be sheet steel and oil tight. Manufacturer shall test one motor to determine capacity, speed and thermal characteristics. A flashing test shall be included at 1500 r. p. m. and at a voltage not exceeding 750 to determine the susceptibility of the motor to flash over on opening and closing the line potential.

Control—Complete control equipment of remote control type, with two master controllers.

Trucks

Bolsters—To be one-piece cast steel, of the swing type and not less than 8″ in width over chafing plates. Play between truck bolsters and transoms shall not exceed ⅛″. Center plates shall have machined contact surfaces with the load carried on anti-friction metal.

Springs—Bolster springs to be of the full or semi-eliptical type having a length of not less than 32″ under a light car. Springs to be so proportioned that the deflection caused by an equally distributed live load of 18,000 lbs. does not exceed 2¼″.

Brake Rigging—Inside hung and provided with slack adjustment. Parts to be interchangeable, and pins body turned, case hardened steel, 1⅛" in diameter. Brake heads to be of malleable iron.

Wheels and Axles—Wheels to be of rolled or forged steel, 34" in diameter, pressed on axles at between 45 and 55 tons pressure. Journal boxes to be of so-called semi-steel, according to the standards of the American Electrical Railway & Engineering Association; wedges of the equalizing type or equivalent; journal brasses of bronze, with 3/16" composition lining. The EB standard axle of the American Electrical Railway & Engineering Association with 5" motor bearings and 4¼"x8" journals to be used. Axles to be of forged open-hearth steel, having not to exceed .05% phosphorous, .05% sulphur, and .60% manganese and a tensile strength of not less than 80,000 lbs. per square inch.

Weight—Weight of each truck complete with wheels, axles, center plates and side bearings to be not over 7,000 lbs.

Air Brake Equipment

Each car shall be provided with a straight air brake equipment.

Air Compressor—To be of the duplex single-acting type having a capacity of 16 cubic feet of free air per minute when operating against a reservoir pressure of 65 lbs., with the motor operating under 600 volts.

Compressor to be designed to run 50% of the time and maintain a reservoir pressure of 60 to 75 lbs. without serious heating. Lubrication of compressor cylinders, connecting rods, and crank shafts to be automatic and by the splash system.

Motor—To be a 600 volt, direct current, series wound motor of the railway type designed for operation on a D. C. line voltage varying from 400 to 600 volts without any external resistance or starting devices. Both motor and compressor to be enclosed in dust and water proof casings.

Governor—To be actuated by compressed air only and to contain neither rubber nor leather diaphragms. Adjustment shall be so arranged that any desired pressure can be obtained without replacing springs or other parts. Governor to be adjusted to close the circuit at 60 lbs. pressure and to open at 75 lbs. pressure, and to be provided with an arc extinguisher.

Valves—Brake valves to be of the piston valve type having graduated admission and release features and provided with release, lap, service and emergency positions. Safety valve to be capable of discharging 20 cubic feet of free air per minute at 75 lbs. pressure and having a range of adjustment from 60 to 100 lbs.

Main Reservoir—To be 16" in diameter and 60" in length, constructed of rolled steel tubing, riveted and brazed; reservoir enameled inside, tested by hydrostatic pressure of 200 lbs. per square inch, and guaranteed to carry 140 lbs. of working pressure.

Brake Cylinder—To be 10" in diameter with a 12" stroke.

Equalizing Levers—To be so proportioned that a brake force equal to 100% of the light weight of the car shall be obtained at the brake shoe with 65 lbs. pressure in the cylinder.

Tests—Air brake system to be charged with air at a pressure of 80 lbs. per square inch and then cut off from the source. There shall be a loss of pressure of not more than 6 lbs. per square inch in 25 minutes.

GENERAL INDEX

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TABLE 1—COMPARATIVE GROWTH IN POPULATION.

PACIFIC COAST CITIES.

	1910. Population.	1910. % Increase.	1900. Population.	1900. % Increase.	1890. Population.	1890. % Increase.	1880. Population.	1880. % Increase.
SAN FRANCISCO..	416,912	21.6	342,782	14.6	298,997	27.8	233,959	56.5
San Francisco and traction district.	728,000	56.2	458,000	12.0	409,000			
Los Angeles	319,198	211.5	102,479	103.4	50,395	350.0	11,183	194.5
Seattle	237,194	194.0	80,671	88.3	42,837	1,113.0	3,533	68.6
Portland	207,214	129.2	90,426	94.9	46,385	264.0	17,577	212.0
Oakland	150,174	124.3	66,960	37.5	48,682	40.9	34,555	329.0
Tacoma	83,743	122.0	37,714	4.7	36,006			

Does not account for area annexed during above periods.

Authority: U. S. Census.

TABLE 2—GROWTH OF COMMUTER DISTRICT.

	1910.	1900.	1890.	1880.	1870.	1860.
SAN FRANCISCO....	416,912	342,782	298,997	233,959	149,473	56,802
Alameda	23,383	16,464	11,165	5,708	1,557	460
Albany	808					
Belvedere	481	434				
Benicia	2,360	2,751	2,361	1,794		
Berkeley	40,434	13,214	5,101			
Burlingame	1,565					
Emeryville	2,613	1,016	228			
Haywards	2,746	1,965	1,419	1,231	504	
Larkspur	594					
Martinez	2,115	1,380	1,600			
Mayfield	1,041					
Mill Valley	2,551					
Oakland	150,174	66,960	48,682	34,555	10,500	1,543
Palo Alto	4,486	1,658				
Piedmont	1,719		634			
Redwood City	2,442	1,653	1,572	1,383	727	
Richmond	6,802					
Ross Valley	556					
San Anselmo	1,531					
San Jose	28,946	21,500	18,060	12,567	9,089	
San Leandro	3,471	2,253		1,369	426	
San Mateo	4,384	1,832				
San Rafael	5,934	3,879	3,290	2,276	841	
Santa Clara	4,348	3,650	2,891			
Sausalito	2,383	1,628	1,334			
South San Francisco..	1,989					
Vallejo	11,340	7,965	6,343	5,987		
Unincorporated places, estimated at 200 each	2,000					
Total...........	730,108	492,984	403,677	300,829	173,117	58,805
Per cent increase.....	48.0	22.3	34.4	73.3	194.5	
Commuter district only	313,196	150,202	104,680	66,870	23,644	2,003
Per cent increase.....	108.7	43.6	56.4	183.0	1,080	

Authority: U. S. Census.

Table 3

TABLE 3—DENSITY OF POPULATION.

BY ASSEMBLY DISTRICTS.

1890.

Assembly District.	Population.	Density per Acre.
29	7,211	34.6
30	9,932	108.0
31	26,838	224.0
32	16,588	120.0
33	13,448	76.4
34	12,229	37.1
35	9,748	114.3
36	9,081	96.0
37	11,890	142.0
38	12,424	109.3
39	13,149	109.7
40	14,967	73.8
41	*15,253	9.6
42	20,975	13.7
43	15,882	16.8
44	22,046	12.3
45	14,200	20.2
46	11,593	20.6
47	18,386	3.3
48	20,157	2.7
Presidio (estimated)	3,000	2.3

*Less Presidio, 3,000 (estimated).

1900.

Assembly District.	Population.	Density per Acre.
28	15,731	64.1
29	15,299	125.0
30	15,347	127.0
31	15,871	92.0
32	14,037	13.7
33	18,758	6.3
34	21,841	58.0
35	17,647	6.1
36	27,836	3.7
37	23,923	18.7
38	19,977	21.2
39	19,905	89.7
40	22,472	15.3
41	*21,235	14.8
42	15,472	89.0
43	23,003	140.5
44	18,631	63.3
45	12,797	46.8
Presidio (estimated)	3,000	2.3

*Less Presidio, 3,000 (estimated).

1910.

Assembly District.	Population.	Density per Acre.
28	11,373	42.2
29	5,537	34.8
30	7,558	36.8
31	18,787	16.4
32	31,879	10.8
33	44,688	8.2
34	36,970	34.3
35	22,388	57.3
36	12,844	40.5
37	35,250	69.7
38	27,925	68.5
39	*48,210	5.6
40	23,075	68.0
41	25,372	26.8
42	8,810	39.0
43	9,379	47.5
44	21,307	66.0
45	22,206	64.6
Presidio (estimated)	3,354	2.6

*Less Presidio, 3,354.

TABLE 4—GROWTH OF MANUFACTURES, INDUSTRIAL DISTRICT OF SAN FRANCISCO.

For calendar year / Census taken	1899 / 1900	% Increase.	1904 / 1905	% Increase or Decrease.	1909 / 1910	% Increase, 1900-1910.
Number of factories—						
San Francisco	1,748	28.7	2,251	—20.2	1,796	2.75
Bay cities	268	38.0	370	55.7	576	215.0
Industrial District	2,016	30.0	2,621	— 9.5	2,372	11.8
Number persons employed—						
San Francisco	....	....	46,666	—20.9	36,910	
Bay cities	....	....	4,217	138.0	10,034	
Industrial District	41,191	23.5	50,883	5.8	47,944	16.5
Value of products—						
San Francisco	$107,023,567	28.6	$137,788,233	— 3.4	$133,041,069	24.3
Bay cities	12,216,781	74.0	21,244,847	38.0	29,332,000	140.0
Industrial District	119,240,348	33.4	159,033,080	2.0	162,373,069	36.2
Population—						
San Francisco	342,782	24.3	427,000*	— 2.3	416,912	21.4
Bay cities	100,106	15.0	115,000*	98.0	228,895	129.0
Industrial District	442,888	22.4	542,000	19.0	645,807	45.8

PER CAPITA RECORD.

Census taken	1900	....	1905	....	1910
Per cent of population employed—					
San Francisco	....	....	10.9	....	8.9
Bay cities	....	....	3.7	....	4.4
Industrial District	9.3	....	185	....	128
Value of products—		....	293	....	251
San Francisco	$312	..	$323	....	$319
Bay cities	122				
Industrial District	269	....	9.4	....	7.4

Authority: U. S. Census Bureau.
*Estimated.

Table 5

TABLE 5—PREDICTION OF STREET RAILWAY EARNINGS.†

SAN FRANCISCO TRACTION SYSTEM.

Year.	Population.	Earnings per Capita.	Earnings.
1910	417,000	$18.35	$ 7,653,489
1911	430,000	18.35*	7,886,136
1912	443,000	18.96	8,400,000
1913	457,000	19.53	8,930,000
1914	471,000	20.11	9,480,000
1915	485,000	20.51	9,950,000
1916	499,000	21.11	10,530,000
1917	513,000	21.70	11,130,000
1918	528,000	22.26	11,750,000
1919	543,000	22.84	12,400,000
1920	558,000	23.48	13,100,000
1921	574,000	23.96	13,750,000
1922	589,000	24.60	14,480,000
1923	605,000	25.12	15,200,000
1924	621,000	25.63	15,920,000
1925	637,000	26.18	16,670,000
1926	654,000	26.66	17,440,000
1927	670,000	27.21	18,230,000
1928	687,000	27.67	19,000,000
1929	705,000	28.22	19,900,000
1930	722,000	28.80	20,800,000
1931	739,000	29.38	21,700,000
1932	757,000	29.86	22,600,000
1933	776,000	30.29	23,500,000
1934	794,000	30.72	24,400,000
1935	813,000	31.12	25,300,000
1936	831,000	31.52	26,200,000
1937	850,000	31.90	27,100,000
1938	870,000	32.20	28,000,000
1939	889,000	32.63	29,000,000
1940	909,000	33.00	30,000,000
1941	929,000	33.38	31,000,000
1942	950,000	33.80	32,100,000
1943	970,000	34.23	33,200,000
1944	991,000	34.61	34,300,000
1945	1,012,000	34.99	35,400,000
1946	1,033,000	35.31	36,500,000
1947	1,055,000	35.61	37,600,000
1948	1,077,000	35.92	38,700,000
1949	1,099,000	36.21	39,800,000
1950	1,121,000	36.57	41,000,000

†Based on the mathematical law of growth shown graphically in Figure 5, starting with earnings of United Railroads system in 1910.
*Earnings per capita, all companies, $20.00.

Table 6

TABLE 6—PREDICTION OF SERVICE REQUIREMENTS TO 1920.

UNIFIED SYSTEM.

Method.	Basis.	Total Single Track Mileage, 1920.	Increase, 1911 to 1920.	Operated Cars. Total.	Increase, 1911 to 1920.	Plus 5% for reserve and Repairs.	Total All Cars.	Increase, All Cars, 1911-1920.	Increase, All Cars, per Year.	Car Mileage, 1920	Earnings, Cents, per Car Mile, 1920.
..	Track actually necessary for extensions, and ratios based thereon. Minimum requirements for reasonable service; car density, 2.52; car miles per car year, 36,700........	414	120	1,043	302	52	1,095	354	39	38,800,000	33.8
2.	Fixed income per car, on basis of earnings of $13,100,000 in 1920, $11,700 per car, 1911. Car miles per car year, 36,700	414	120	1,120	379	56	1,176	435	48	41,000,000	32.0
3.	On basis of operating ratio of 65%, and expense of 20 cents per car mile operated. Car miles per car year 1911, 36,700	414	120	1,160	419	58	1,218	477	53	42,500,000	30.8

TABLE 7—GROWTH OF CAR EQUIPMENT.

CITY OF SAN FRANCISCO.

Year.	Number of Operating Car Units Upon Which License Taxes Were Paid. Total for City.	Total for U. R. R.	Number as Reported From Poor's Manual. Steam.	Horse.	Cable.	Electric.	Total for City.	Total for U. R. R.
1898	600		39	191	614	302	1,146	
1899	598		21	105	583	348	1,057	
1900	541		19	103	567	349	1,038	
1901	610		19	111	526	399	1,055	
1902	674	600	16	15	596	438	1,065	905
1903	687	600	16	13	576	441	1,046	898
1904	687	600	16	3	607	472	1,098	917
1905	737	650						921*
1906	737	650	16	4	606	426	1,052	871
1907	417	375			206	459	665	484
1908	485	425			206	459	665	484
1909	554	475			120	489	609	484
1910	589	500			138	599	737	612
1911	621	530			110	599	709	612
1912	676	585						669†

*Statement to Assessors.
†Statement to State Board of Equalization.

TABLE 8—GROWTH OF STREET RAILWAY TRACK MILEAGE.

CITY OF SAN FRANCISCO.

Year.	Steam.	Horse.	Cable.	Electric.	Total.
1860					3.0
1868					30.0
1871					45.0
1875					80.0
1887					142.0
1889					156.5
1890					183.5
1891					179.5
1894	20.3	59.0	112.5	47.7	239.5
1895	20.3	34.4	109.4	84.3	248.4
1896	21.7	34.5	106.6	107.0	269.8
1897	21.7	29.6	104.0	114.9	270.2
1898	22.0	22.7	103.5	114.5	262.7
1899	13.8	16.0	101.7	129.0	260.5
1900	13.8	12.0	101.3	143.9	271.0
1901	13.8	6.8	87.4	157.9	265.9
1902	10.1	5.9	87.9	166.3	270.2
1903	10.1	5.9	86.2	186.9	289.1
1904	10.1	5.9	86.2	191.3	293.5
1905	2.0	5.9	84.3	206.2	298.4
1907	2.0	5.9	84.3	206.2	298.4
1908	2.0	2.0	46.4	242.9	293.3
1909			38.9	246.4	285.3
1910			33.9	255.7	289.6
1911			35.5	259.0	294.5

TABLE 9—APPROXIMATE COST OF EXTENSIONS.

UNIFIED SYSTEM.

Including only roadbed, overhead, cars, and power converting equipment.*

Period.	Miles of single track.	Cost.	Per cent of grand total.
Immediate:			
City	66.92		
Outside	4.76		
	71.68	$5,730,000	51.0
After five years:			
City	44.00		
Outside	3.79		
	47.79	3,820,000	34.0
Ultimate:			
City	21.37		
Outside	0.0		
	21.37	1,710,000	15.0
Total city	132.29		94.0
Total outside control	8.55		6.0
Grand total	140.84	$11,260,000	100.0

*Assuming power purchased, alternating current, thus excluding cost of power stations and transmission lines.

TABLE 10—UNIFIED SYSTEM. GENERAL DESCRIPTION OF LOCATIONS.

IMMEDIATE EXTENSIONS.

Extension.	From	To	Streets Traversed.
Army St.	Castro St.	Kentucky St.	Twenty-sixth St. (Church St.); Army St.
*Belt Line (City control)	Embarcadero	Buchanan St.	Jefferson St.; Ft. Mason Tunnel; Beach St.
Belt Line (State control)	Ferry	Jefferson St.	Embarcadero.
*Bernal Cut	Thirtieth St.	S. Jose Ave. and Diamond St.	Dolores St. and Bernal Cut.
*Broadway Tunnel Lines	Mason St.	Larkin St.	
*Broadway Tunnel Lines	Larkin St.	Van Ness Ave.	Broadway.
*Broadway Tunnel Lines	Broadway	Vallejo St.	Larkin St.
*Chestnut St.	Polk St.	Greenwich St.	Chestnut and Divisadero Sts.
**Church St.	Sixteenth St.	Chenery St.	Church St.; Mission Park; Chattanooga Tunnel; Church St.; Thirtieth St.
*Cole St. and Masonic Ave.	Stanyan St.	Geary St.	Rivoli St.; Cole St.; Waller St.; Masonic Ave.
*Columbus Ave.	Union St.	Jefferson St.	Columbus Ave.
Cortland Ave. Line	Cortland Ave.	Peralta St.	Folsom St. and Powhattan St.
Divisadero Crosstown Line	Eighteenth St.	Page St.	Noe St.; Duboce Ave.; Scott St.
**Duboce Ave.	Market St.	Sixteenth and Masonic	Duboce Ave.; Castro St.; 14th St.; Tilden St.
*Eighth and Connecticut Sts.	Bryant St.	Twenty-second St.	8th St.; 16th St.; Conn. St.; 20th St. Arkansas St.
Evans Ave. (Fifth Ave. South)	Railroad Ave.	Ingalls St.	Evans Ave.
Excelsior Ave.	Mission St.	Lagrande Ave.	Excelsior Ave.; Naples St.; Persia Ave.
Farallones St.	San Jose Ave.	Randolph St.	Farallones St.
*Fillmore Tunnel	Sutter St.	Filbert St.	
*Franklin St.	Van Ness Ave.	Chestnut St.	Union St. and Franklin St.
*Geary Street Lines	Geary St.	Great Highway	33d Ave.; Balboa St.; 45th Ave.; Cabrillo St.
**Geary Street Lines	Balboa St.	Fulton St.	Thirty-seventh Ave.
*Geary Street Lines	Kearny St.	Sansome St.	Market St.
*Greenwich St.	Fillmore St.	Baker St.	Greenwich St.
Hayes St. (electrification)	Fillmore St.	Divisadero St.	Hayes St.
Hoffman Ave.	Twenty-fourth St.	Switchback	Hoffman and View Aves.
**Laguna St.	Fourteenth St.	Geary St.	Guerrero and Laguna Sts.
Lee and Grafton Aves.	Ocean Ave.	Garfield Ave.	Lee and Grafton Aves.
New street connection	Lyell and Bosworth Sts.	San Jose and Diamond	New street parallel with Southern Pacific Line.
Ninth Avenue Line	Ninth Ave. and Pacheco St.	Forest Hill Tract	Street through city property.
**Oak St.	Market St.	Fillmore St.	Oak St.
Pacific Ave. (electrification)	Polk St.	Broderick St.	Pacific Ave.
Pacific Ave. (extension)	Broderick St.	Lyon St.	Pacific Ave.
Polk St.	Lombard St.	Exposition Loop Terminal	Polk St.; Bay St.; Fort Mason.
Post St.	Larkin St.	Leavenworth St.	Post St.
Potrero Ave.	Division St.	Army St.	Potrero Ave.
**Presidio Line (Government control)	Union St. Line	Fort Point	
San Bruno Ave.	Dwight St.	Railroad Ave.	San Bruno Ave.
**Silver Ave.	Mission St.	San Bruno Ave.	Silver Ave.
*Steiner St.	Union St.	Greenwich St.	Steiner St.
*Stockton Tunnel Line	Market St.	Columbus Ave.	Stockton St.
*Tenth and Ninth Aves.	Fulton St.	Judah St.	Park and Ninth Ave.
**Tenth Ave.	Geary St.	California St.	Tenth Ave.
**Turk St. and Arguello Boulevard	Masonic Ave.	Sac'to St. (Washington)	Turk St. and Arguello Boulevard.
*Twelfth St.	Otis St.	Potrero Ave.	Twelfth and Division Sts.
*Twentieth St.	Chattanooga St.	Potrero Ave.	Twentieth St.
*Van Ness Ave.	Mission St.	Bay St.	Van Ness Ave.

EXTENSIONS AFTER FIVE YEARS.

Extension.	From	To	Streets Traversed.
**Balboa St.	Arguello Boulevard	Thirty-third Ave.	Balboa St.
Belt Line (City control)	Embarcadero	Potrero Ave.	Berry and Division Sts.
*Belt Line (City control)	Buchanan St.	Lyon St.	Beach St.
Belt Line (State control)	Berry St.	Ferry	Embarcadero.
Belt Line (Government control)	Lyon St.	Terminal in Presidio	Beach St.
**Cambridge St.	Silver Ave.	Wayland St.	Cambridge St.
Castro St. (cable)	Twenty-sixth St.	Thirtieth St.	Twenty-sixth and Diamond Sts.
**Cherry St. (City control)	Sacramento St.	Presidio	Cherry St.
**Cherry St. and Presidio (Gov't control)	Cherry St.	Fort Point Line	Into the Presidio.
**Crescent Contour St.	Mission and Bosworth Sts.	S. Bruno Ave. and Cresc't St.	New contour street.
*Eureka St.	Eighteenth St.	Market St. Extension	Eureka St.
*Forty-eighth Ave.	Sloat Boulevard	Lincoln Way	Forty-eighth Ave.
*Garfield St.	Grafton Ave.	Junipero Serra Boulevard	Garfield St.
*Judah St.	Ninth Ave.	Twentieth Ave.	Judah St.
**Laguna St.	Geary St.	Sutter St.	Laguna St.
*Lawton St.	Forty-eighth Ave.	Twentieth Ave.	Lawton St.
Lincoln Way	First Ave.	Stanyan St.	New street.
*Market St. Extension	Castro St.	Falcon Ave.	Market St. Extension.
*Mission Sunset Tunnel Line	Market St. Extension	Stanyan St.	Mission Sunset Tunnel and Frederick St.
*Randolph St.	Farallones St.	Junipero Serra Boulevard	Randolph St.
**Seventh and Corbett Aves.	Parnassus Ave.	View Ave.	Seventh, Corbett and Falcon Aves.
*Sunnyside Ave.	Genesee St.	Sloat Boulevard	New streets.
Sutter St.	Presidio Ave.	Parker and Euclid Aves.	Laurel Hill Cemetery.
**Taraval St.	Forty-eighth Ave.	Thirty-third Ave.	Taraval St.
*Taraval St.	Twentieth Ave.	Twin Peaks Tunnel Portal	Taraval St.
** Thirty-seventh and Thirty-third Aves.	Fulton St.	Lincoln Way	Across the Park.
**Twenty-eighth St.	Corbett Ave.	Douglass St.	Burnett Ave. and Twenty-eighth St.
*Twin Peaks Tunnel Rapid Transit Line	Otis St.	County Line	Twin Peaks Tun'l and Junipero Serra Bvd.
*Van Ness Ave.	Bay St.	Jefferson St.	Van Ness Ave.

ULTIMATE EXTENSIONS.

Extension.	From	To	Streets Traversed.
*Army St.	Kentucky St.	Waterfront	Army St.
Clarendon Ave.	Clayton St.	Sutro Forest	Clarendon Ave.
*Cliff Line	Cliff Ave.	Cabrillo	Great Highway.
Cortland Ave. Line	Powhattan and Peralta Sts.	Precita Ave.	Brewster; Isabel; Wolfe; Alabama.
Eighteenth St. Line	Guerrero St.	Folsom St.	Eighteenth St.
*Evans Ave. (Fifth Ave. South)	Ingalls St.	Waterfront	Evans Ave.
Fillmore St.	Bay St.	Waterfront	Fillmore St.
*Fourteenth St.	Guerrero St.	Church St.	Fourteenth St.
*Fourteenth St.	Harrison St.	Bryant St.	Fourteenth St.
*Glen Park	Bosworth St.	Corbett Ave.	Glen Ave.; Twin Peaks Ave.; 28th St.; Kenyon Ave.; 27th St.
Kentucky St.	Berry St.	Hubbell St.	Third and Kentucky Sts.
*Leese and Cambridge Sts.	Mission St.	Silver Ave.	By viaduct.
Naples St.	Persia Ave.	Walbridge Ave.	Naples St.
*Oakdale Ave. (Fifteenth Ave. South)	San Bruno Ave.	Railroad Ave.	Oakdale Ave.
Ocean Ave.	Onondaga Ave.	Mission St.	Ocean Ave.
*Revere Ave. (Eighteenth Ave. South)	Railroad Ave.	Waterfront	Revere Ave.
*San Jose Ave.	Thirtieth St.	Randall St.	San Jose Ave.
*Sixteenth St.	Noe St.	Church St.	Sixteenth St.
*Tenth Ave.	California St.	Lake St.	Tenth Ave.
*Thirty-third Ave.	Taraval St.	Lincoln Way	Thirty-third Ave.
*Tiffany Ave.	Valencia St.	Twenty-ninth St.	Tiffany Ave.
*Twenty-fourth and Twentieth Aves.	Geary St.	Lincoln Way	Twenty-fourth Ave., across the Park.
*Twin Peaks Scenic Line	Clarendon Ave.	Corbett Ave.	New streets.
*Woolsey and Wayland Sts.	San Bruno Ave.	Cambridge St.	Woolsey and Wayland Sts.

Asterisks refer to lines available for municipal system:
*Lines to be first constructed.
**Lines to be next constructed.

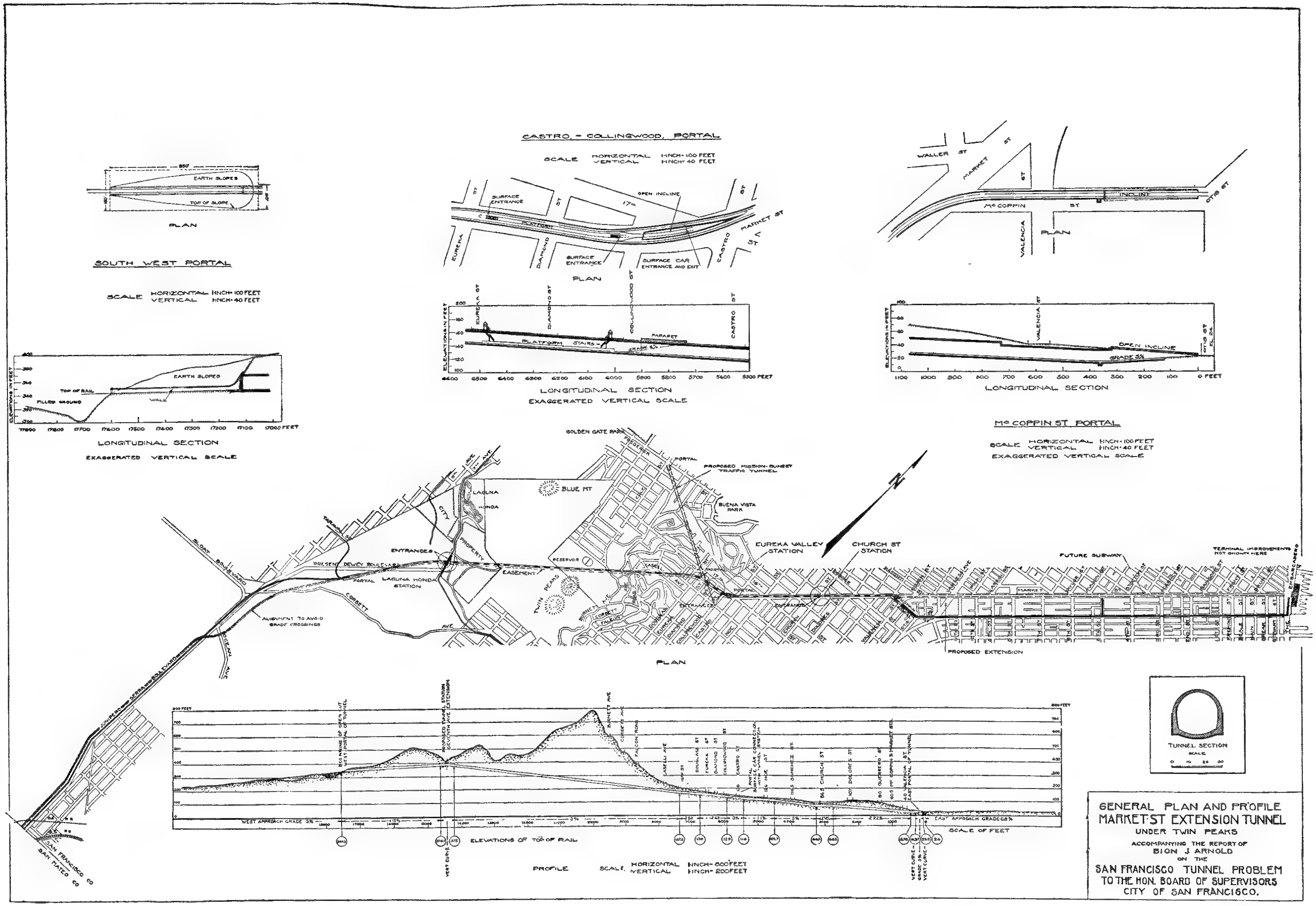


PLATE 13.—MARKET STREET EXTENSION TUNNEL UNDER TWIN PEAKS, GENERAL LINE PLAN AND PROFILE.

Showing alignment, grades, distances, easements, stations, portals, and proposed connections discussed in Chapter 11. Grade separation of the future right-of-way south of the portal is indicated. This plan corresponds to Plan 5B.

TABLE 14—PROGRAM OF IMPROVEMENTS IN CITY PLAN NECESSARY FOR THE COMPLETION OF THE TRANSIT SYSTEM PLANNED.

These improvements, the necessity therefor, and the results to be accomplished are discussed in Chapter 12, "Street Improvements."

IMMEDIATE.

1. Hayes Street cut.
2. Extension and fill of Jefferson Street waterfront.
3. Park crossings.
4. Van Ness Avenue parking.
5. Eighth Street extension.
6. Opening and improvement of Berry Street.
7. Recession of Sacramento Street corner at the Ferry.
8. Improvement of Bernal Cut and Circular Avenue.
9. Extension of Dolores, San Jose and Mission Streets into Bernal Cut.
10. Extension of Potrero Avenue and Twenty-sixth Street.
11. San Bruno fill, and improvement of San Bruno Avenue and Army Street.
12. Contour extension of Market Street into Eureka Valley and around Twin Peaks.
13. Tunnel into Noe Valley and approaches.
14. *Extension to Army of Capp, Howard and Treat Streets.
15. Extension of Van Ness Avenue to Mission.
16. *Extension of Capp to Fourteenth Street.
17. Extension of Alpine to Tilden, for Buena Vista Heights line.
18. Reduction of sidewalk widths to preserve roadway.
19. Widening of Leese (formerly Holly) Street.
20. Regrade of Twentieth Street west of Potrero.
21. *Extension of Pierce Street to Hamilton Square.
22. Extension of Twelfth Street to Division Street.
23. Extension of Ninth Avenue through city property to Forest Hill.
24. Regrade of Arkansas, between Twentieth and Twenty-second.
25. *Regrade of Thirty-third, between Geary and Anza.
26. Panhandle crossing at Masonic Avenue.
27. New street connection from Bosworth and Lyell to San Jose and Diamond, paralleling Southern Pacific line.
28. Automobile stands at Union Square.

AFTER FIVE YEARS.

29. Improvement of Division Street.
30. Equalization of Embarcadero frontage at the Ferry.
31. Improvement of Seventh Avenue extension boulevard through San Miguel Rancho.
32. Extension of Fourteenth Street to Division.
33. Contour streets through cemeteries.
34. Proposed new contour street (Islais Avenue?), San Bruno to Bosworth.
35. Extension of Lincoln Way to Stanyan.
36. Extension of Falcon Avenue to Corbett.
37. Extension of Randolph Street to Junipero Serra Boulevard.
38. Straightening of Corbett Road.
39. Viaduct in Balboa Street over Twenty-third Avenue.
40. Extension of Taraval Street to Twin Peaks tunnel portal.
41. *Extension of Vicente Street to Twin Peaks tunnel portal.
42. Grading of Twenty-eighth Street, between Burnett Avenue and Bellevue Street.
43. Connecting Sloat Boulevard and Sunnyside Avenue.

ULTIMATE.

44. Glen Park connecting boulevard.
45. Opening of Ocean Avenue.
46. Regrading Sansome Street.
47. New street, Wayland to Woolsey.
48. Wolfe Street extension to Montcalm Street.
49. Army Street fill east of Kentucky.
50. Contour extension of Brewster Street to Powhattan.
51. Utilization of Third Street bridge for street railways.
52. Viaduct over Islais Creek, between Leese and Cambridge Streets.
53. Grade separation, rapid transit lines at Ingleside.

*Essential to competitive municipal system.

TABLE 15—CAPACITY OF INDIVIDUAL LINES AND TUNNELS.

SERVICE LINES TO EXPOSITION.
(See Fig. 13.)

Name of Line.	Max. grade.	Headway (sec's).	Cars per hr.	Capacity. Car.	Capacity. Route.
Cherry street and Presidio	10.0	30	120	100	12,000
Presidio avenue and Presidio	11.0	30	120	100	12,000
Franklin-Broadway-Gough	12.4	30	120	100	12,000
Van Ness avenue	9.8	30	120	100	12,000
Polk and Larkin line	10.9	30	120	100	12,000
Larkin-Vallejo-Franklin	10.2	30	120	100	12,000
Columbus avenue-Jefferson (or North Point)-Fort Mason	8.0	30	120	100	12,000
Embarcadero-Jefferson (or North Point)-Fort Mason	8.0	30	120	100	12,000
Presidio and Ferries line, via Broadway tunnel and Steiner street	8.8	30	120	100	12,000
Van Ness avenue, via Broadway tunnel	7.3	30	120	100	12,000
*Presidio and Ferries line	13.8	45	80	60	4,800
Hyde street cable line	20.4	120	30	100	3,000
Fillmore balanced cable way	25.4	144	25	60	1,500
Fillmore tunnel	2.3	30	120	100	12,000
Broadway tunnel	1.0	30	120	100	12,000
Fort Mason tunnel	0.0	30	120	100	12,000

*From Larkin street to Steiner street the capacity is 12,000, as the grades permit the use of standard equipment and 30-second headway.

Note: As portions of above routes are identical, the resulting duplication has been considered in the following tables in establishing minimum headway at "throats."

Table 16

TABLE 16—RECOMMENDED ROUTES WITHOUT TUNNELS.

SERVICE LINES TO EXPOSITION.

Line and Routing.	Max. grade.	Headway (sec's).	Cars per hr.	Capacity. Car.	Capacity. Route.	Total.
PRIVATE COMPANIES.						
Polk Street—						
Polk-Chestnut-Main entrance	9.6	60	60	100	6,000	
Polk-Ft. Mason-Waterfront loop	10.9	150	24	100	2,400	
*Polk-Vallejo-Franklin-Union-Steiner-Greenwich-Main entrance	8.8	100	36	100	3,600	
Hyde Street Cable—						
O'Farrell-Jones-Pine-Hyde	20.4	120	30	100	3,000	
Fillmore Cable Way—						
Fillmore street	25.4	144	25	60	1,500	
Total private companies						16,500
MUNICIPAL.						
Franklin Street—						
Franklin-Broadway-Gough-Concessions	12.4	30	120	100	12,000	
Van Ness Avenue—						
Van Ness-Chestnut-Main entrance	9.8	60	60	100	6,000	
Van Ness-Fort Mason-Waterfront loop	9.8	150	24	100	2,400	
Van Ness-Vallejo-Franklin-Union-Steiner-Greenwich-Main entrance	9.8	100	36	100	3,600	
Columbus Avenue—						
*Kearny-Columbus-North Point-Fort Mason	7.8	60	60	100	6,000	
Belt Line—						
Embarcadero-North Point-Fort Mason-Waterfront loop	8.0	120	30	100	3,000	
Presidio and Ferries—						
Ferry-Columbus-Union-Larkin-Vallejo-Franklin-Union-Baker-Greenwich	13.8	45	80	60	4,800	
Total municipal						37,800
Total unified						54,300

*Route part municipal and part private companies.

Notes: As the franchise will expire in 1913, the present Union street line has been included with the municipal lines.

The above capacity requires new lines both on Van Ness avenue and on Franklin street.

The "throats" or points where two or more lines are obliged to use the same route have limited the capacity to figures given.

TABLE 17—RECOMMENDED ROUTES WITH TUNNELS.

SERVICE LINES TO EXPOSITION.

Line and Routing.	Max. grade.	Headway (sec's).	Cars per hr.	Capacity. Car.	Capacity. Route.	Total.
PRIVATE COMPANIES.						
Polk Street—						
Polk - Chestnut - Main entrance	9.6	45	80	100	8,000	
Polk-Fort Mason-Waterfront loop	10.9	90	40	100	4,000	
Hyde Street Cable—						
O'Farrell-Jones-Pine-Hyde	20.4	120	30	100	3,000	
Fillmore Cable Way—						
Fillmore street	25.4	144	25	60	1,500	
Total, private companies						16,500
MUNICIPAL.						
Fillmore Tunnel—						
Geary - Fillmore tunnel-Greenwich-Main entrance	9.2	30	120	100	12,000	
Columbus Avenue—						
Stockton tunnel-Columbus-Fort Mason tunnel-Waterfront loop	7.7	90	40	100	4,000	
Belt Line—						
Embarcadero-Jefferson-Fort Mason tunnel-Waterfront loop	0.0	72	50	100	5,000	
Presidio and Ferries—						
Ferry-Columbus-Union-Larkin-Vallejo-Franklin-Union-Baker-Greenwich	13.8	45	80	60	4,800	
Broadway Tunnel and Franklin—						
Ferry - Broadway tunnel - Larkin -Vallejo - Franklin-Concessions	8.8	90	40	100	4,000	
Stockton tunnel - Broadway tunnel -Van Ness - Union-Franklin-Concessions	8.8	45	80	100	8,000	
Total municipal						37,800
Total unified						54,300

Note: The capacities of the Franklin-Broadway-Gough and Van Ness avenue lines are not included in the list of routes with tunnels.

TABLE 18—VOLUME OF VEHICLE TRAFFIC.

OBSERVATIONS BY TRAFFIC BUREAU, POLICE DEPARTMENT.

March, April and July, 1912.

Count Points.	Average Hourly Traffic.
Third and Market	730
Fourth and Market	982
Post and Kearny	478
Sutter and Kearny	472
Sutter and Grant	473
Post and Grant	528
Geary and Grant	449
O'Farrell and Stockton	449
Sutter and Powell	323
Ellis and Powell	354
Sutter and Montgomery	459
Third and Mission	721
Fourth and Mission	826
Sixteenth and Mission	420
Polk and Sutter	417
Fillmore and Sutter	160
Post and Stockton	397
Third and Howard	469
Fourth and Howard	468
Sixth and Market	722

TABLE 19—TYPICAL OPERATING SPEED.

MAIN THOROUGHFARES.

Streets.	Distance.	Time.	Miles per Hour.	Location.
CITY TERMINAL:				
Market	0.552	7′ 06″	4.664	Sansome-Powell.
Post	0.71	6′ 45″	6.306	Montgomery-Leavenworth.
Kearny and Third	0.485	5′ 45″	5.058	Bush-Howard.
Sutter	0.331	9′ 00″	2.206	Sansome-Stockton.
Montgomery	0.443	4′ 30″	5.906	Washington-Post.
Average			4.416	
SLOW:				
Sacramento	1.47	11′ 30″	7.658	Stockton-Fillmore.
California	2.80	21′ 45″	7.7	Market-Presidio.
Divisadero	1.48	12′ 30″	7.104	Oak-Sacramento.
Third	0.836	8′ 00″	6.27	Townsend-Market.
Mission	0.595	7′ 00″	5.099	Valencia-Richland.
Haight	0.86	8′ 00″	6.88	Market-Divisadero.
Leavenworth	0.461	4′ 00″	6.915	Post-McAllister.
Average			6.685	
MEDIUM:				
Sixteenth	0.983	7′ 00″	8.415	Bryant-Church.
Hayes	0.831	6′ 00″	8.3	Larkin-Fillmore.
Hayes and Stanyan	1.53	6′ 00″	9.18	Divisadero-Fulton.
Sutter	0.965	6′ 00″	9.65	Kearny-Van Ness.
Bryant	1.23	8′ 00″	9.225	Third-Alameda.
Larkin	0.709	5′ 00″	8.232	Market-Post.
Eddy	1.184	8′ 00″	8.88	Mason-Webster.
Market and Castro	1.06	7′ 00″	9.08	Gough-Eighteenth.
McAllister	1.47	10′ 30″	8.393	Market-Divisadero.
Folsom	0.773	5′ 30″	8.425	Steuart-Fourth.
Guerrero	1.09	8′ 00″	8.175	Eighteenth-Vallejo.
Gough	0.441	2′ 45″	9.621	McAllister-Haight.
Average			8.931	
RAPID:				
O'Farrell	1.31	7′ 30″	10.48	Hyde-Divisadero.
Mission	1.61	9′ 00″	10.722	Third-Fourteenth.
Kentucky	1.26	5′ 45″	13.14	Hubble-Twenty-third St.
Valencia	1.89	11′ 00″	10.26	Gough-Mission.
Point Lobos Ave.	0.988	5′ 00″	11.856	33d Ave.-48th Ave.
Howard	1.07	6′ 15″	10.272	3d St.-10th St.
Fulton	1.48	6′ 15″	14.17	8th Ave.-33d Ave.
Clement	1.48	8′ 45″	10.151	8th Ave.-33d Ave.
Lincoln Way	2.79	14′ 00″	11.938	1st Ave.-48th Ave.
Average			11.311	

Average speed for entire city (schedule), 8.529 miles per hour.

TABLE 20—CAR LOADING STANDARDS.

ELECTRIC EQUIPMENT.

Type.	Seats.	Total Capacity. I. Comfortable.	II. Normal, Max.	III. Emergency, Max.	Per Cent Loading. I. Comfortable.	II. Normal, Max.	III. Emergency, Max.	Routes Operated On
1-12	56	100	106	122	178	189	218	San Mateo.
101-180	44	98	108	134	218	248	305	Hayes; Sutter.
681-698	44	71	99	127	161	225	289	Kentucky.
700-712	43	79	88	110	184	195	256	Kearny; Parkside.
731-745	40	73	97	137	182	243	343	Folsom.
1001-1024	40	73	94	135	182	235	337	Mission and 24th.
1225-1244	48	72	78	82	150	162	171	Cemeteries.
1300-1425	40	73	77	96	182	192	240	Fillmore-Valencia; Fillmore-Sixteenth; Mission-Richmond; Kearny.
1500-1549	44	80	87	100	182	198	227	McAllister, 9th and Polk.
1550-1749	44	86	93	110	195	211	250	Valencia, Haight; Ellis-Ocean, Market; Ingleside, Howard.
Single truck	28	55	75	99	196	288	353	18th St., Fillmore Hill; Sixth and Sansome; Tenth and Montgomery.
Geary	47	81	87	105	172	185	223	New.
1912, U. R. R.	49	88	95	121	179.3	194	246	New.

Seating capacity, longitudinal seats, based on 17 inches per passenger.
I. Comfortable standing—150% cross seats, 200% longitudinal seats.
II. Normal maximum loading (3 square feet per passenger).
III. Emergency maximum loading (2 square feet per passenger), (both platforms or both running boards).

TABLE 21—CORDON OR THROAT COUNTS.

POINTS OF OBSERVATIONS.

	Count No.	
Powell at Post	30	North.
Third at Brannan	39	South.
Polk at Sutter	25	North.
Sutter at Polk	26-A-B	West.
Eddy at Jones	27	West.
Ellis at Jones	29	West.
Post at Powell	32	West.
Kearny at Sacramento	38	North.
Sacramento at Kearny	37	West.
Kearny at Pacific (Union line only)	41	North.
Fourth at Townsend	40	South.
California at Kearny	33	West.
Geary at Jones	34	West.
Jones at O'Farrell	35	North.
Folsom at Fifth	44	South.
Mission at Tenth	51	South.
Bryant at Eighth	45	South.
Harrison at Eighth	52	South.
Market at McAllister	55	West.
Market at Sutter	64	East.
California at Drumm	106	East.
Sansome at Broadway	107	North.
Ninth at Mission	108	South.
East at Clay	109	East.
East at Mission	111	East.
East at Mission	112	East.

Note: Counts taken at transfer points include outbound transfer traffic on trunk lines.

TABLE 22—SUMMARY OF THROAT COUNTS.

OUTBOUND TRAFFIC FROM BUSINESS DISTRICT.

Rush Hour, 5 to 6 p. m.

UNITED RAILROADS.	Total passengers.	Seats furnished.	Loading—% of seating capacity. For hour.	Per max. 30 min.	Per max. 15 min.
To City Only—					
Electric Lines:					
Third at Brannan	1,555	1,731	101.2	103.4	103.5
Polk at Sutter	1,197	748	159.6	173.2	182.8
Sutter at Polk	3,586	1,886	190.1	194.1	203.8
Eddy at Jones	1,509	880	171.1	179.8	187.6
Ellis at Jones	2,626	1,496	175.4	206.0	206.4
Post at Powell	595	522	114.1	121.8	127.5
earny at Sacramento	1,567	1,312	119.5	122.1	141.9
ourth at Townsend	207	968	21.4	24.2	32.3
olsom at Fifth	893	620	144.1	180.2	205.8
ission at Tenth	6,435	3,024	212.2	230.0	235.0
yant at Eighth	1,898	1,360	139.3	150.9	174.4
arrison at Eighth	128	377	38.0	46.8	46.5
arket at McAllister	11,722	5,672	206.8	216.3	232.1
inth at Mission	455	792	57.6	72.0	81.9
insome at Broadway	27	261	10.3	10.3	13.8
Total electric to city	34,400	21,649	158.8	168.9	183.0
Cable Lines:					
owell at Post	1,479	924	159.9	166.5	167.8
acramento at Kearny	736	576	127.7	138.1	141.6
Total cable to city	2,215	1,500	147.4	108.0	156.8
Total to city	36,615	23,149	158.2	163.1	181.1
erry Only—					
Electric Lines:					
arket at Sutter	5,284	5,674	93.2	94.2	108.8
ast at Mission	1,828	3,402	53.7	57.2	61.4
ast at Clay	36	344	10.5	15.7	18.6
Total electric to Ferry	7,148	9,420	75.9	77.0	89.0
Cable Lines:					
East at Clay	198	540	36.6	41.2	55.5
Total cable to Ferry	198	540	36.6	41.2	55.5
Total to Ferry	7,346	9,960	73.8	75.4	87.4
Grand Total—U. R. R.	43,961	33,109			

TOTAL OUTBOUND TRAFFIC—ALL COMPANIES.

OTHER COMPANIES.	Total passengers.	Seats furnished.	Loading—% of seating capacity. For hour.	Per max. 30 min.	Per max. 15 min.
To City Only—					
Electric Lines:					
Kearny at Pacific	607	504	120.3	135.2	139.3
Total electric to city	607	504	120.3	135.2	139.3
Cable Lines:					
California at Kearny	1,289	850	151.7	158.1	159.8
Geary at Jones	955	780	122.5	127.9	136.4
Jones at O'Farrell	1,355	600	226.0	240.0	254.6
Total cable to city	3,599	2,230	161.3	169.1	175.5
Total to city	4,206	2,734	153.8	163.1	169.2
To Ferry Only—					
Electric Lines:					
East at Clay	215	532	40.4	42.1	58.8
Total electric to Ferry	215	532	40.4	42.1	58.8
Cable Lines:					
California at Drumm	277	816	33.9	49.4	59.2
Total cable to Ferry	277	816	33.9	49.4	59.2
Total to Ferry	492	1,348	36.5	46.7	59.1
Grand Total—Other Lines	4,698	4,082			
Total City Bound—					
Electric	35,007	22,153	158.9	185.0	182.1
Cable	5,814	3,730	155.9	138.0	168.3
Total	40,821	25,883	157.8	163.5	180.3
Total Ferry Bound—					
Electric	7,363	9,952	74.0	77.1	87.6
Cable	475	1,356	35.0	45.2	57.9
Total	7,838	11,308	69.3	72.2	83.8
Total electric, outbound	42,370	32,105			
Total cable, outbound	6,289	5,086			
Grand Total	48,659	37,191			

TOTAL OUTBOUND TRAFFIC, BY PERIODS—ALL COMPANIES.

	5:00-5:15	5:15-5:30	5:30-5:45	5:45-6:00	Total.
City Bound Only—					
Passengers	9,463	11,591	10,023	9,744	40,821
Per cent loading	142	178	150	151	158
Ferry Bound Only—					
Passengers	2,546	1,784	2,156	1,352	7,838
Per cent loading	78	65	83	59	69
Total Passengers	12,009	13,375	12,179	11,096	48,659

TABLE 23—ANALYSIS OF RUSH-HOUR SERVICE, OUT-BOUND FROM BUSINESS DISTRICT.

BY LINES, THROATS AND PERIODS.

		Interval.	McAllister.	Hayes.	Haight.	Market.	Valencia.	Market St. Throat.	Harrison.		1st and 5th.	Brannan St. Throat.	Ellis-Ocean.	Hayes-Ellis.	4th St. Throat.
Cars passing, actual......		15′	5	3	7	6	7	28	2		1	3	4	3	7
		15′	5	6	6	7	6	30	3		1	4	3	2	5
		15′	6	5	7	7	6	31	2		1	3	3	2	5
		15′	8	6	9	8	8	39	2		1	3	3	2	5
Seats passing, actual	15′	210	86.4	84	380.4	180	168	86.4	126	380.4	210	86	86	382	155
	15′	126	86.4	84	296.4	144	168	86.4	84	338.4	126	86	43	255	155
	15′	168	86.4	84	338.4	108	126	86.4	42	254.4	168	129	86	383	155
	15′	168	86.4	42	296.4	144	168	86.4	126	380.4	168	86	86	340	155
Total..........		672	345.6	294	1311.6	576	630	345.6	378	1353.6	672	387	301	1360	620
Passengers	15′	258	68	81	407	214	128	147	185	460	354	17	146	517	239
	15′	258	83	78	419	174	125	195	122	442	313	32	100	445	319
	15′	270	104	79	453	144	89	190	48	327	316	24	202	542	216
	15′	207	74	7	288	204	49	79	122	250	228	11	155	394	119
Total..........		993	329	246	1567	736	391	611	477	1479	1211	84	603	1898	893
Per cent loading	15′	122.8	78.6	96.4	107.1	118.8	76.1	170.5	146.8	121.4	168.3	19.8	169.7	135.3	154.2
	15′	204.4	96.0	94.1	141.9	120.8	74.3	225.6	145.1	130.8	248.3	37.2	232.3	174.4	205.8
	15′	160.7	120.2	94.1	134.0	133.2	70.6	220.0	114.1	128.7	188.1	18.6	234.5	141.2	139.4
	15′	160.7	85.5	16.7	97.3	141.6	29.1	85.7	96.8	65.8	135.7	12.8	180.2	115.9	76.8
Per cent loading	30′	153.5	87.4	95.3	122.1	119.7	75.4	197.6	146.0	125.3	198.2	28.4	190.7	150.9	130.2
	30′	141.9	102.9	68.2	116.8	138.1	46.9	155.5	101.1	90.9	161.9	16.3	207.5	129.4	108.1
Per cent loading	60′	147.6	95.1	83.6	119.5	127.7	62.1	176.3	126.1	109.1	180.2	21.7	201.3	139.3	144.1
Point of observation.......		Kearny at Sacramento.				Sac'to at Kearny.	Third at Brannan.				Bryant at 8th.				Folsom at 5th.

Table 23

TABLE 23 (Cont'd)—ANALYSIS OF RUSH-HOUR SERVICE, OUT-BOUND FROM BUSINESS DISTRICT.

BY LINES, THROATS AND PERIODS.

	Interval.	Union Throat.	California Throat.	Jones-Hyde Throat.	Geary (cable) Throat.
Cars passing, actual.....	15′	4	7	6	5
	15′	6	6	7	5
	15′	4	6	6	5
	15′	4	6	6	5
Seats passing, actual	15′	112	238	144	195
	15′	168	204	168	195
	15′	112	204	144	195
	15′	112	204	144	195
Total...............		504	850	600	780
Passengers	15′	99	342	297	190
	15′	205	300	366	266
	15′	156	326	361	239
	15′	147	321	331	260
Total...............		607	1289	1355	955
Per cent loading	15′	88.4	143.4	206.2	97.5
	15′	122.0	147.0	217.9	136.4
	15′	139.3	159.8	250.5	122.6
	15′	131.2	157.3	230.0	133.4
Per cent loading	30′	108.7	145.0	212.2	116.9
	30′	135.2	158.1	240.0	127.9
Per cent loading	60′	120.3	151.7	226.0	122.5
Point of observation		Kearny at Pacific.	Calif. at Kearny.	Jones at O'Farrell.	Geary at Jones.

	Interval.	Harrison St. Throat.	Glen Park.	24th-Mission.	Ingleside.	Cemeteries.	Mission.	Guerrero.	San Mateo.	Mission St. Throat.	6th-Sansome Throat.	9th-Polk Throat.
Cars passing, actual......	15′	4	3	2	3	2	2	2	0	14	2	5
	15′	3	3	8	3	2	3	3	2	24	3	4
	15′	3	1	7	2	2	2	3	1	18	1	4
	15′	3	2	4	2	2	2	1	0	13	3	5
Seats passing, actual.....	15′	116	126	84	132	96	88	84	0	610	58	220
	15′	87	126	335	132	96	132	126	112	1059	87	176
	15′	87	42	294	88	96	88	126	56	790	29	176
	15′	87	84	167	88	96	88	42	0	565	87	220
Total...............		377	378	880	440	384	396	378	168	3024	261	792
Passengers	15′	54	273	190	336	202	208	141	0	1350	3	140
	15′	36	274	906	314	260	254	259	221	2488	12	144
	15′	22	56	612	154	186	170	234	100	1512	3	99
	15′	16	190	318	148	205	134	90	0	1085	9	72
Total...............		128	793	2026	952	853	766	724	321	6435	27	455
Per cent loading	15′	46.5	216.5	226.0	254.4	210.3	236.5	167.9	0.0	221.3	5.2	64.1
	15′	41.4	217.4	270.2	237.5	270.8	192.4	205.2	197.3	235.0	13.8	81.9
	15′	25.3	133.3	208.2	175.0	193.8	193.1	185.6	178.4	191.5	10.3	56.2
	15′	18.4	226.0	190.5	168.2	213.5	152.3	214.2	0.0	192.1	10.3	82.7
Per cent loading	30′	46.8	217.1	261.9	246.2	241.2	210.0	190.5	197.3	230.0	10.3	72.0
	30′	21.8	195.2	203.4	171.6	207.0	172.7	192.8	178.5	191.5	10.3	43.2
Per cent loading	60′	38.0	209.5	230.0	216.2	222.3	193.5	191.4	191.1	212.2	10.3	57.6
Point of observation...........		Harrison at 8th.				Mission at 10th St.					Sansome at Broadway.	9th at Mission.

	Interval.	Glen Park.	24th-Mission.	Ingleside.	Cemeteries.	Guerrero.	Folsom.	Howard.	Harrison.	Embarcadero Throat.
Cars passing, actual	15′	2	7	3	2	3	5	2	3	27
	15′	2	5	3	1	2	3	2	3	21
	15′	1	6	2	2	2	3	1	3	20
	15′	2	3	1	1	1	3	1	3	15
Seats passing, actual	15′	84	293	132	96	126	213	88	87	1119
	15′	84	209	132	48	84	128	88	87	860
	15′	42	251	88	96	84	128	44	87	820
	15′	84	126	44	48	42	128	44	87	603
Total....................		294	879	396	288	336	597	264	348	3402
Passengers	15′	28	112	108	32	30	176	13	106	605
	15′	31	74	31	33	48	178	18	115	528
	15′	24	168	31	29	26	52	8	151	489
	15′	12	17	9	31	2	98	3	34	206
Total....................		95	371	179	125	106	504	42	406	1828
Per cent loading	15′	33.3	38.2	81.8	33.3	23.8	82.6	14.8	121.9	54.1
	15′	36.9	35.4	23.5	68.7	57.1	139.0	20.4	132.1	61.4
	15′	57.1	66.9	35.2	30.2	31.0	40.6	18.2	173.6	59.6
	15′	14.3	13.5	20.4	64.5	4.8	76.5	68.1	39.1	34.1
Per cent loading	30′	35.1	37.1	52.6	45.1	37.1	103.8	17.6	127.0	57.2
	30′	28.6	49.0	30.3	41.6	22.2	58.6	12.5	106.2	48.8
Per cent loading	60′	32.3	42.2	45.2	43.4	31.6	84.4	15.9	116.7	53.7
Point of observation................						Embarcadero at Mission.				

	Interval.	McAllister.	Hayes.	Haight.	Market.	Valencia.	Market St. Throat.	Sacramento.	Kentucky.	Union.	Embarcadero Throat.	Calif. Throat.
Cars passing, actual......	15′	6	5	7	5	11	34	4	2	6	12	7
	15′	6	5	6	7	8	32	3	2	4	9	5
	15′	6	6	10	7	8	37	4	2	4	10	6
	15′	6	5	6	6	2	25	4	2	5	11	6
Seats passing, actual	15′	264	230	308	220	484	1506	144	86	168	398	238
	15′	264	230	264	308	352	1418	108	86	112	306	170
	15′	264	276	440	308	352	1640	144	86	112	342	204
	15′	264	230	264	264	88	1110	144	86	140	370	204
Total.............		1056	966	1276	1100	1276	5674	540	344	532	1416	816
Passengers	15′	247	242	404	174	571	1638	80	16	66	162	141
	15′	209	145	225	255	283	1117	24	11	43	78	61
	15′	264	337	449	186	260	1496	56	5	66	127	44
	15′	276	199	327	187	44	1033	38	4	40	82	31
Total..............		996	923	1405	802	1158	5284	198	36	215	449	277
Per cent loading	15′	93.6	105.2	131.1	79.1	117.9	108.8	55.5	18.6	39.2	40.7	59.2
	15′	79.1	63.0	85.1	82.7	80.4	78.7	22.2	12.8	38.3	25.4	35.8
	15′	100.0	122.0	102.0	60.3	73.9	91.2	38.8	5.8	58.8	37.1	21.6
	15′	100.7	66.5	223.8	70.8	50.0	93.1	26.4	4.7	28.6	22.1	15.2
Per cent loading.........	30′	86.4	84.1	110.0	81.3	102.1	94.2	41.2	15.7	38.9	34.1	49.4
	30′	102.1	105.8	110.2	65.2	87.5	91.9	32.6	5.2	42.1	29.3	18.4
Per cent loading.........	60′	94.3	95.6	110.0	72.9	91.6	93.2	36.6	10.5	40.4	31.7	33.9
Point of observation..................				Market at Sutter.					Embarcadero at Clay.			Calif. at Market.

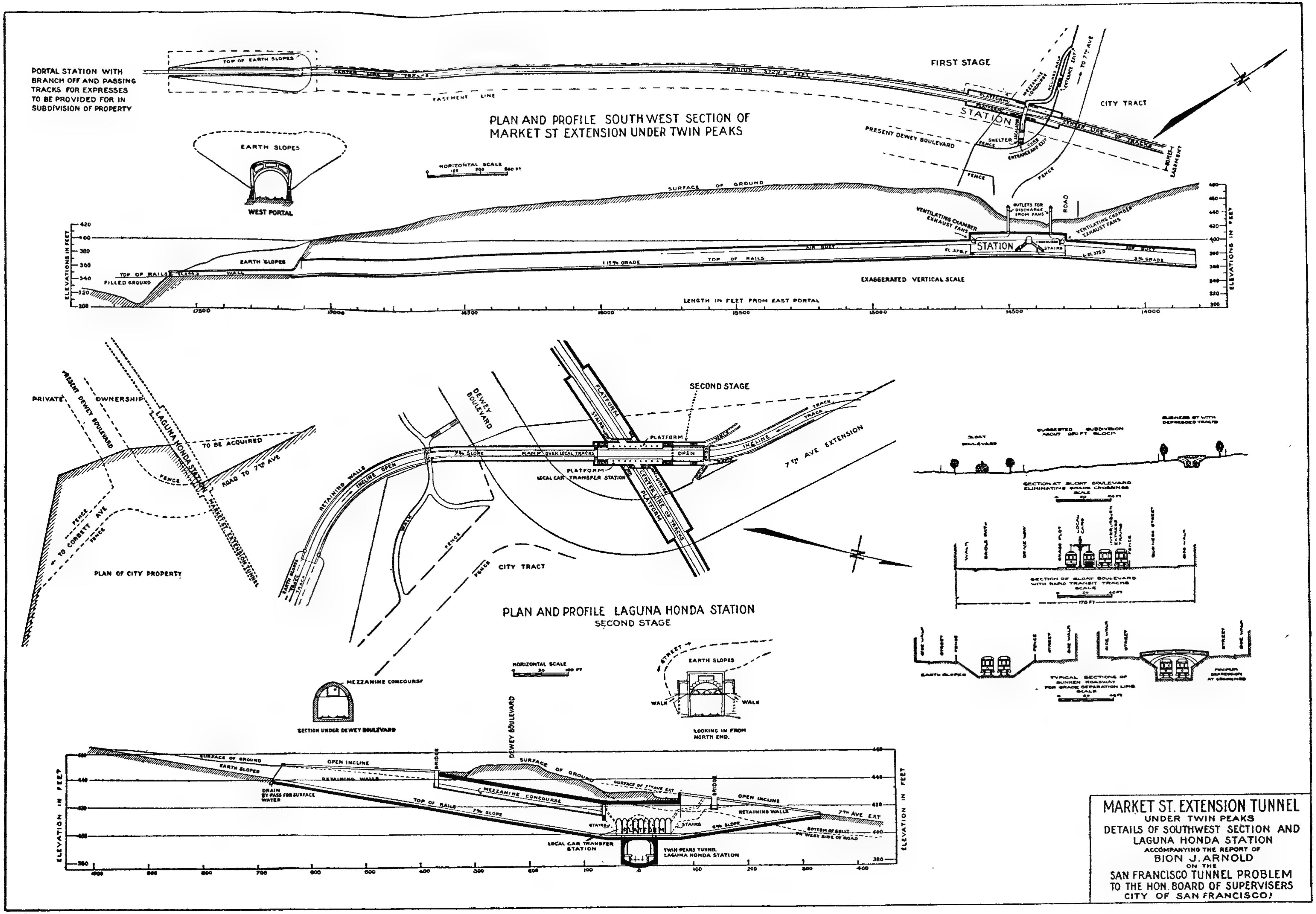


PLATE 15.—DETAILS OF MARKET STREET EXTENSION TUNNEL UNDER TWIN PEAKS.

Plan, profile and details of southwest section, omitting tangent section of bore under Twin Peaks. Arrangement of Laguna Honda station detailed as to first and second construction stage, providing for most convenient cross-town transfer facilities consistent with the possible elevation of the main bore at this point.

TABLE 23—ANALYSIS OF RUSH-HOUR SERVICE, OUT-BOUND FROM BUSINESS DISTRICT.

BY LINES, THROATS AND PERIODS.

	Interval.	McAllister.	Hayes.	Haight.	Market.	Valencia.	Market St. Throat.	Harrison.	1st and 5th.	Brannan St. Throat.	Ellis-Ocean.	Hayes-Ellis.	4th St. Throat.
Cars passing, actual......	15′	5	3	7	6	7	28	2	1	3	4	3	7
	15′	5	6	6	7	6	30	3	1	4	3	2	5
	15′	6	5	7	7	6	31	2	1	3	3	2	5
	15′	8	6	9	8	8	39	2	1	3	3	2	5
Seats passing, actual......	15′	220	138	308	264	308	1238	58	29	87	176	132	308
	15′	220	276	264	308	264	1332	87	29	116	132	88	220
	15′	264	230	308	308	264	1374	58	29	87	132	88	220
	15′	352	276	396	352	352	1728	58	29	87	132	88	220
Total................		1056	920	1276	1232	1188	5672	261	116	377	572	396	968
Passengers	15′	407	245	645	533	639	2469	8	15	23	29	28	57
	15′	495	555	659	700	683	3092	24	4	28	60	11	71
	15′	500	384	634	575	530	2623	11	0	11	34	11	45
	15′	655	567	864	637	815	3538	14	0	14	24	10	34
Total................		2057	1751	2802	2445	2667	11722	57	19	76	147	60	207
Per cent loading	15′	184.9	177.2	209.3	201.9	207.3	199.3	13.8	51.8	26.4	16.5	21.2	18.5
	15′	225.0	200.8	249.2	227.2	258.9	232.1	27.6	13.8	24.1	45.4	12.5	32.3
	15′	189.2	166.9	201.6	186.8	200.8	191.0	19.0	0.0	12.6	25.7	12.5	20.5
	15′	185.8	205.4	218.1	180.8	231.5	204.8	24.1	0.0	16.1	18.2	11.4	15.5
Per cent loading	30′	204.6	193.1	228.2	215.7	231.1	216.3	22.0	32.8	25.1	28.9	17.7	24.2
	30′	187.3	187.9	212.6	183.8	218.4	198.6	21.5	0.0	14.4	22.0	11.9	18.0
Per cent loading	60′	184.9	190.2	219.5	198.5	224.2	206.8	21.8	16.4	20.2	25.7	15.2	21.4
Point of observation............		Market at McAllister.						Third at Brannan.			Fourth at Townsend.		

	Interval.	Powell.	Jackson.	Powell St. Throat.	9th-Polk Throat.	Sutter-California.	Sutter-Clement.	Sutter-Jackson.	Sutter St. Throat.	Turk-Eddy Throat.	Ellis-Ocean.	Hayes-Ellis.	Ellis St. Throat.	6th-Sansome.	10th-Montg'y.	Post St. Throat.
Cars passing, actual	15′	5	4	9	5	4	4	3	11	6	8	2	10	2	2	4
	15′	4	5	9	4	4	3	2	9	5	4	4	8	2	3	5
	15′	2	5	7	4	4	4	3	11	5	7	2	9	2	2	4
	15′	4	4	8	4	3	4	3	10	4	5	2	7	2	3	5
Seats passing, actual	15′	140	112	252	220	184	184	138	506	264	352	88	440	58	58	116
	15′	112	140	252	176	184	138	92	414	220	176	176	352	58	87	145
	15′	56	140	196	176	184	184	138	506	220	308	88	396	58	58	116
	15′	112	112	224	176	138	184	138	460	176	220	88	308	58	87	145
Total....		420	504	924	748	690	690	506	1886	880	1056	440	1496	232	290	522
Passengers ...	15′	191	177	368	267	325	335	207	867	384	492	91	583	66	67	133
	15′	167	245	412	316	395	278	171	844	413	330	285	615	88	96	184
	15′	73	256	329	332	341	387	241	969	392	625	167	792	60	70	130
	15′	148	222	370	282	298	386	222	906	320	474	162	636	46	102	148
Total....		579	900	1479	1197	1359	1386	841	3586	1509	1921	705	2626	260	335	595
Per ct. loading,	15′	136.4	157.9	146.0	121.2	176.7	182.2	149.8	171.2	145.7	139.8	103.3	132.3	114.1	116.0	114.5
	15′	149.0	175.0	163.5	179.5	214.4	201.5	185.8	203.8	187.6	187.2	161.9	174.8	153.3	110.2	127.5
	15′	130.2	182.8	167.8	188.5	185.2	210.0	174.6	191.0	178.1	202.5	189.8	200.0	103.3	120.7	112.0
	15′	132.1	198.2	165.1	160.0	215.8	209.8	160.7	197.1	181.8	215.5	184.3	206.4	79.2	117.2	102.0
Per ct. loading,	30′	141.9	167.1	154.9	147.2	195.4	190.1	164.1	186.0	164.7	155.4	142.3	157.3	133.3	112.3	121.8
	30′	131.4	189.6	166.5	174.1	192.0	210.0	168.0	194.1	179.8	207.6	186.9	206.0	91.4	118.7	106.5
Per ct. loading,	60′	137.9	178.3	159.9	160.1	196.7	200.6	166.2	190.1	171.1	182.2	160.2	175.4	112.4	115.6	114.1
Point of observation...		Powell at Post.			Polk at Sutter.	Sutter at Polk.				Eddy at Jones.	Ellis at Jones.			Post at Powell.		

	Interval.	Kearny-Beach.	Kentucky.	Kearny-Br'dway.	K'rny St. Throat.	Sac'to St. Throat	Kearny-Beach.	Kentucky.	Kearny-Br'dway.	3d St. Throat.	Bryant.	8th-18th.	San Bruno.	Bryant St. Throat.	Folsom St. Throat.
Cars passing, actual.	15′	5	2	2	9	5	4	2	3	9	5	2	2	9	4
	15′	3	2	2	7	4	4	2	2	8	3	2	1	6	4
	15′	4	2	2	8	3	3	2	1	6	4	3	2	9	4
	15′	4	2	1	7	4	4	2	3	9	4	2	2	8	4
Seats passing, actual	15′	210	86.4	84	380.4	180	168	86.4	126	380.4	210	86	86	382	155
	15′	126	86.4	84	296.4	144	168	86.4	84	338.4	126	86	43	255	155
	15′	168	86.4	84	338.4	108	126	86.4	42	254.4	168	129	86	383	155
	15′	168	86.4	42	296.4	144	168	86.4	126	380.4	168	86	86	340	155
Total..........		672	345.6	294	1311.6	576	630	345.6	378	1353.6	672	387	301	1360	620
Passengers	15′	258	68	81	407	214	128	147	185	460	354	17	146	517	239
	15′	258	83	78	419	174	125	195	122	442	313	32	100	445	319
	15′	270	104	79	453	144	89	190	48	327	316	24	202	542	216
	15′	207	74	7	288	204	49	79	122	250	228	11	155	394	119
Total..........		993	329	246	1567	736	391	611	477	1479	1211	84	603	1898	893
Per cent loading . ..	15′	122.8	78.6	96.4	107.1	118.8	76.1	170.5	146.8	121.4	168.3	19.8	169.7	135.3	154.2
	15′	204.4	96.0	94.1	141.9	120.8	74.3	225.6	145.1	130.8	248.3	37.2	232.3	174.4	205.8
	15′	160.7	120.2	94.1	134.0	133.2	70.6	220.0	114.1	128.7	188.1	18.6	234.5	141.2	139.4
	15′	160.7	85.5	16.7	97.3	141.6	29.1	85.7	96.8	65.8	135.7	12.8	180.2	115.9	76.8
Per cent loading	30′	153.5	87.4	95.3	122.1	119.7	75.4	197.6	146.0	125.3	198.2	28.4	190.7	150.9	180.2
	30′	141.9	102.9	68.2	116.8	138.1	46.9	155.5	101.1	90.9	161.9	16.3	207.5	129.4	108.1
Per cent loading	**60′**	**147.6**	**95.1**	**83.6**	**119.5**	**127.7**	**62.1**	**176.3**	**126.1**	**109.1**	**180.2**	**21.7**	**201.3**	**139.3**	**144.1**
Point of observation.......		Kearny at Sacramento.				Sac'to at Kearny.	Third at Brannan.				Bryant at 8th.				Folsom at 5th.

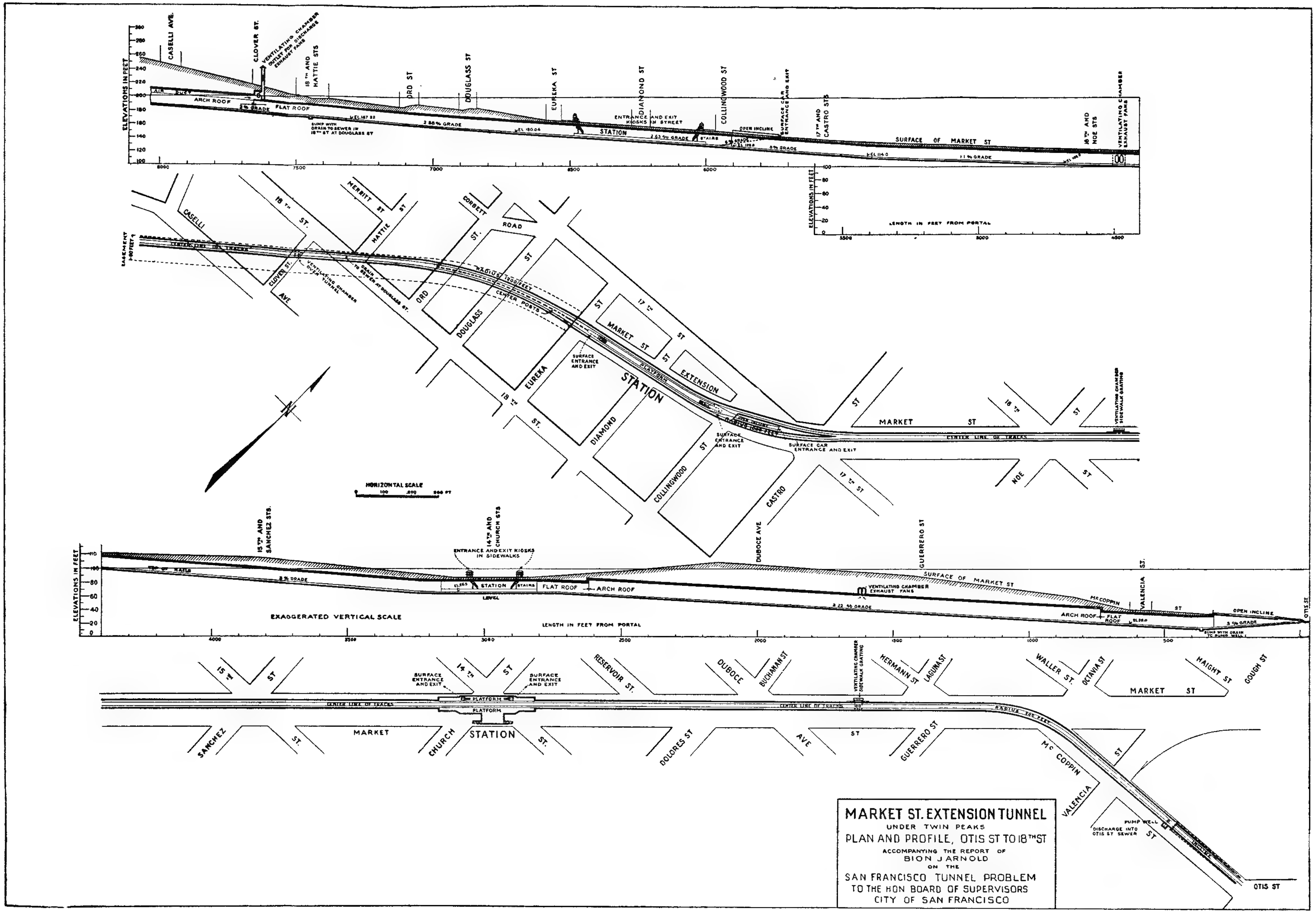


PLATE 14.—DETAILS OF MARKET STREET EXTENSION TUNNEL UNDER TWIN PEAKS.

Plan and profile, Otis Street to Eighteenth Street, showing in some detail the design and track layout of the Market Street section. Providing for a side platform station at Church Street designed to permit future transfer facilities to a sub-level two-track express bore to be built on south side of Market Street. Center island platform at Eureka Valley station permitting a future local reservoir station at the portal of the proposed Mission-Sunset tunnel. Contour extension of Market Street contemplated.

TABLE 26—RECOMMENDED RUSH-HOUR ROUTING AND SERVICE DISTRIBUTION

UNITED RAILROADS LINES

Route	*Routing—Outbound*	*Trips*
Sutter and California.	Ferry via Market, Sutter, Presidio, California, 33rd Avenue to Beach	5
	Ferry via Market, Sutter, Presidio, California to 33rd Avenue	5
	Sansome-Bush-Montgomery loop via Sutter, Presidio, California to 33rd Avenue	5
Sutter and Clement.	Ferry via Market, Sutter, Presidio, California, Parker, Clement to Beach	10
	Sansome-Bush-Montgomery loop via Sutter, Presidio, California, Parker, Clement to 33rd	8
Sutter-Presidio.	Sansome-Bush-Montgomery loop via Sutter, Presidio to Jackson	6
Eddy-Hayes.	Eddy and Market via Eddy, Divisadero, Hayes, Stanyan to Fulton	10
Eddy-Richmond.	Eddy and Market via Eddy, Divisadero, McAllister, Fulton, 8th Avenue to Clement	12
McAllister.	Ferry via Market, McAllister, Fulton to Beach	6
	Ferry via Market, McAllister, Fulton to 13th Av.	4
	Ferry via Market, McAllister, Fulton to car barns	10
Hayes.	Ferry via Market, Hayes, Fillmore, Oak and Page, Masonic, Frederick, Clayton, Cole, Stanyan, Parnassus, 9th Avenue to Pacheco	10
	Ferry via Market, Hayes, Fillmore, Oak and Page, Masonic, Frederick, Clayton, Cole to Stanyan	5
Hayes-Sunset.	5th and Market via 5th, Mission, 10th, Hayes, Fillmore, Page and Oak, Stanyan, Lincoln Way, 20th Avenue to Boulevard	4
	5th and Market via 5th, Mission, 10th, Hayes, Fillmore, Page and Oak, Stanyan, Lincoln Way to 20th Avenue	8
Haight.	Ferry via Market, Haight to Stanyan	25
Haight-Ocean.	1st and Market via 1st, Mission, 12th, Market, Haight, Stanyan, Lincoln Way to Beach	10
	1st and Market via 1st, Mission, 12th, Market, Haight, Stanyan, Lincoln Way to 20th Avenue	6
Market.	Ferry via Market, Castro, 18th to Danvers	12
	Ferry via Market, Castro to 18th	20
Valencia.	Ferry via Market, Valencia, Mission, 29th to Noe	26
	Ferry via Market, Valencia to Mission	9
Sunnyside.	1st-Folsom-2nd loop via Mission. 14th, Guerrero, 30th, Chenery, Diamond, Sunnyside to Genesee	7
	1st-Folsom-2nd loop via Mission, 14th, Guerrero, 30th, Chenery, Diamond to Bosworth	5
24th and Mission.	Ferry via Mission, 22nd, Dolores and Chattanooga, 24th to Hoffman	14
	1st and Market via Mission, 22nd, Dolores and Chattanooga, 24th to Hoffman	14
Ingleside.	Ferry via Mission, Onondaga, Ocean, Boulevard to Beach	6
	Ferry via Mission, Onondaga, Ocean to Boulevard	2
Cemeteries.	Ferry via Mission to Cemeteries	6

TABLE 26—RECOMMENDED RUSH-HOUR ROUTING AND SERVICE DISTRIBUTION

CONTINUED

Route	*Routing—Outbound*	*Trips*
Kearny-Beach.	From depot via Townsend, 3rd, Kearny, Broadway, Stockton, Union, and Powell to Jefferson......	15
Kearny-Broadway.	Broadway via Kearny, 3rd, Berry, 4th, Kentucky, Railroad Avenue to 32nd Avenue So..................	9½
Kentucky.	Ferry via East, Broadway, Kearny, 3rd, Berry, Kentucky, Railroad Avenue to County Line...........	6
	Ferry via East, Broadway, Kearny, 3rd, Berry, Kentuckv. Railroad Avenue to 32nd Ave. So...........	1½
Mission-Daly City.	5th and Market via 5th, Howard, 14th, Mission to Daly City	9
Mission.	2nd and Market via 2nd, Mission to Onondaga........	11
9th and Polk.	Brannan via 9th, Larkin, Post, Polk to Lombard......	18
Ellis-Richmond.	Mail Dock via Townsend, 4th, Ellis, Hyde, O'Farrell, Divisadero, Sacramento, 6th Avenue to Fulton....	7
	Depot via Townsend, 4th, Ellis, Hyde, O'Farrell, Divisadero, Sacramento, 6th Avenue to Fulton....	14
Ellis-Fillmore-Jackson.	Market and Ellis via Ellis, Hyde, O'Farrell, Fillmore, Jackson to Presidio............................	10
Fillmore and 16th.	23rd and Kentucky via Kentucky, 18th, Connecticut, 17th, Kansas, 16th, Church, 13th, Fillmore to Broadway	16
	Bryant and 16th via 16th, Church, 13th, Fillmore to Broadway	10
Fillmore-Valencia.	Richland and Mission via Mission, Valencia, Gough, McAllister, Fillmore, Sacramento, Presidio to California	8
Mission-Richmond.	Utah and 24th via 24th, Howard, 22nd, Mission, 16th, Church, 13th, Fillmore, Oak and Page, Divisadero, Sacramento, 6th Avenue, Clement to 13th Avenue..	10
San Bruno.	5th and Market via 5th, Bryant, Army, San Bruno Road to Dwight................................	9½
Guerrero.	Ferry via Mission, 14th, Guerrero, 30th, Chenery, Diamond, San Jose Avenue to Daly City........	8
Bosworth.	Mission to Berkshire via Bosworth.................	4
Bryant.	2nd and Market via 2nd, Bryant and Brannan, 26th, Mission, Cortland to Banks	10
	2nd and Market via 2nd, Bryant and Brannan, 26th to Mission	3
Divisadero Extension.	Sacramento to Jackson via Divisadero...............	7½
Eighteenth.	3rd and Harrison via Harrison, 14th, Guerrero, 18th, Ashbury, Frederick, Clayton, Waller to Stanyan...	6
	8th and Harrison via Harrison, 14th, Guerrero, 18th, Ashbury, Frederick, Clayton, Waller to Stanyan...	6
Eighth and Eighteenth.	8th and Market via 8th, Bryant, 16th, Kansas, 17th, Connecticut, 18th, Kentucky to 23rd Avenue So....	10
Folsom.	Ferry via Folsom, Precita and Army................	13
Harrison.	Ferry via East, Folsom, Steuart, Harrison, Stanley, Bryant, 2nd, Brannan, 3rd, Townsend to Depot..	11
Howard.	Ferry via Howard, 24th to Utah....................	12

TABLE 26—RECOMMENDED RUSH-HOUR ROUTING AND SERVICE DISTRIBUTION

CONTINUED

Route	*Routing—Outbound*	*Trips*
Tenth and Montgomery.	Kearny-Washington-Montgomery loop via Post, Leavenworth, McAllister, Larkin, Fulton, Polk, 10th to Bryant	10
Fillmore Hill.	Broadway to Bay via Fillmore	12
San Mateo.	5th-Mission-6th loop via Howard, 26th, Mission to San Mateo (limited stop)	4
Sixth and Sansome.	Brannan via 6th, Taylor, Post, Kearny, Bush, Sansome to Chestnut	9
Visitacion.	Railroad Avenue to Mission Street via private right-of-way	4
Castro.	18th to 26th via Castro	17
Powell and Jackson.	Powell and Market via Powell, Jackson and Washington to Steiner	18
Powell and Mason.	Powell and Market via Powell, Jackson, Washington, Mason, Columbus, Taylor to Bay	14
Sacramento.	Ferry via Sacramento and Clay to Fillmore	15
Post-Polk-Pacific.	Kearny-Washington-Montgomery loop via Post, Polk, Pacific to Broderick	12
Mission-16th.	Bryant via 16th, Mission to Richland (rush hour only)	10

TABLE 27—ADDITIONAL OUTBOUND RUSH HOUR TRIPS REQUIRED FROM BUSINESS DISTRICTS.*

OPERATED TO PRESENT TERMINI.

Route.	Additional Trips Required.	Period of Underservice.†	Round Trip Miles.	Car Miles.
McAllister	5	1-2-3-4	9.558	47.790
Haight	7	1-2-3-4	7.882	55.174
Market	5	1-2-3	6.676	33.380
Valencia	9	1-2-3-4	9.112	82.008
Ninth and Polk	1	2-3	5.002	5.002
Sutter and California	2	2- 4	10.750	21.500
Sutter and Clement	2	3-4	10.980	21.960
Turk and Eddy‡				
Ellis and Ocean	2	3-4	9.990	19.980
Kentucky	2	3	13.150	26.300
Bryant	2	2-3	7.624	15.248
Folsom	1	2	8.024	8.024
Glen Park	3	1-2- 4	13.000	39.000
Twenty-fourth and Mission	7	1-2-3-4	9.600	67.200
Ingleside	3	1-2	20.506	61.518
Cemeteries	6	1-2-3-4	21.494	128.964
Mission	3	1-2-3	13.434	40.302
Guerrero	2	2- 4	16.014	32.028
San Mateo	1	2	13.434	13.434
San Bruno	2	2-3	10.620	21.240
	65			740.052

*Based upon comfortable capacity determined in Chapter 5, reduced 10% on prepayment cars to compensate for non-uniform loading.

†Numbers refer to the four 15-minute periods of the rush hour.

[illegible] minute period should be changed to second period.

Table 28

TABLE 28. AVERAGE LENGTH OF RIDE

No.	Route	Average Passenger Ride Miles
Electric		
12	Ingleside	3.38
14	Cemeteries	3.14
42	San Mateo	2.81
10	Glen Park	2.80
1	Sutter and California	2.45
18	Mission	2.38
A	Geary (Municipal) to 10th Ave. and Fulton	2.37
25	San Bruno	2.35
26	Guerrero	2.30
11	24th and Mission	2.27
9	Valencia	2.22
31	8th and 18th	2.10
4	Turk and Eddy	2.09
2	Sutter and Clement	2.03
16	Kentucky	2.02
23	Fillmore-Valencia	2.00
34	Bryant	2.00
35	Howard	1.99
5	McAllister	1.98
8	Market	1.90
6	Hayes	1.86
24	Mission-Richmond	1.85
33	Folsom	1.79
8	Haight	1.77
21	Hayes-Ellis	1.70
20	Ellis and Ocean	1.64
22	Fillmore and 16th	1.55
3	Sutter and Jackson	1.50
30	18th	1.39
45	Union	1.39
37	10th and Montgomery	1.10
19	9th and Polk	0.95
15	Kearny and Beach	0.85
43	6th and Sansome	0.62
	Weighted Average for All Electric Cars	1.87
Cable		
49	Geary (Cable)	2.10
54	Sacramento	1.23
51	Powell and Jackson	0.96
50	O'Farrell and Jones	0.82
53	Powell and Mason	0.69
47	California	0.69
48	Castro	0.54
	Weighted Average for All Cable Cars	1.12

Average ride for entire city, 1.68 miles.
Average haul for 5-cent fare, 2.4 miles.

TABLE 29—SCHEDULE OF ROLLING STOCK.

UNITED RAILROADS OF SAN FRANCISCO.

Class or Serial Numbers.	Number of Cars in Commission.	Kind of Car.	Builders and Date of Purchase.	Weight, Equip'd. Lbs.	Seating Cap'y. Cross.	Seating Cap'y. Longitudinal.	Length Over Bumpers.	Length Closed Section.	Length Platform or Open Section.	Width Over Drips.	Width Over Steps.
1-12	12	Closed interurban	St. Louis Car Co., 1906	80,000	40	16	52′ 1″	40′ 0″	6′ 0″	9′ 0″	9′ 4″
101-180	80	Closed prepayment	Jewett Car Co., 1911	46,000	0	44	47′ 0″	32′ 4″	7′ 4″	9′ 2″	8′ 10″
601-663	63	Single truck original "California" type		14,000	0	28	27′ 0″	11′ 8″	7′ 8″	8′ 4″	9′ 2″
681-698	17	Original "California" type	St. Louis Car Co. Hammond Car Co. 1900	38,000	28	16	37′ 6″	19′ 0″	9′ 3″	8′ 10″	9′ 8″
700-719	20	"California" type prepayment	United Railroads, 1912	38,000	16	27	41′ 4″	14′ 6″	13′ 5″	8′ 4″	9′ 8″
731-745	15	Original "California" type	Holman Car Co.	33,000	0	40	37′ 5″	16′ 0″	10′ 8½″	8′ 6″	9′ 9″
1001-1024	23	Original "California" type		32,000	0	40	34′ 0″	15′ 6″	9′ 3″	8′ 5″	9′ 7″
1225-1244	18	Closed suburban	St. Louis Car Co., 1903	56,000	48	0	45′ 9″	34′ 6″	5′ 7½″	9′ 6″	9′ 6″
1301-1425	123	"California" type	St. Louis Car Co., 1903-4	38,000-40,000	20	20	39′6″ to 40′6″	15′ 2″	12′2″ to 12′8″	8′ 6″	9′ 6″
1500-1549	50	Closed prepayment	American Car Co., 1906	52,000	28	16	45′ 9″	32′ 4″	6′ 8½″	9′ 0″	9′ 2″
1550-1749	199	Closed prepayment	St. Louis Car Co., 1907	56,000	16	28	45′ 4″	32′ 4″	6′ 6″	9′ 2″	9′ 0″
1-6; 15-28	18	Original "California" type—cable		14,000	0	34	34′ 0″	11′ 0″	11′ 6″	7′ 5½″	7′ 10″
502-542	26	Half open, half closed—cable		12,000	0	28	26′ 10″	12′ 3″	10′ 7″	7′ 8″	8′ 0″
46-77	5	Cable, dummy and trailer.									

Class or Serial Numbers.	Trucks Type.	Trucks Motor Position.	Trucks Wheel Base.	Trucks Truck Centers.	Motors Number.	Motors H. P. Each	Type.	Control.	Brakes.	Wheels Diam.	Wheels Material.
1-12	St. Louis 61-A	Inside	6′ 8″	29′ 4″	4	75	G. E. 73	C-6-K	Air	34″	Steel
101-180	Standard 0-50	Outside	4′ 6″	20′ 10″	4	50	G. E. 216	K-28-J	Air	33″	Cast Iron
601-663	Peckham Single	Inside	7′ 0″		2	{35 / 37	G. E. 1000 / G. E. 58	K-10	Hand	30″	Cast Iron
681-698	Brill 27-G	Outside	4′ 0″	22′ 0″	4	35	G. E. 1000	K-12	Air	30″	Cast Iron
700-719	Brill 27-G	Outside	4′ 0″	23′ 0″	4	35	G. E. 1000	K-12	Air	30″	Cast Iron
731-745	Peckham 14-B-3-S	Outside	4′ 1″	21′ 0″	4	35	G. E. 1000	K-12	Hand	30″	Cast Iron
1001-1024	Peckham 14-B-3-S	Outside	4′ 1″	17′ 0″	4	35	G. E. 1000	K-12	Hand	30″	Cast Iron
1225-1244	Brill 27-E-1	Inside	6′ 0″	23′ 0″	4	50	G. E. 57	K-14	Air	33″	Cast Iron
1301-1425	Peckham 14-B-3-S	Outside	4′ 1″	23′ 6″	4	35	G. E. 1000	K-12	Air	30″	Cast Iron
1500-1549	McGuire 10-A	Inside	6′ 0″	20′ 6″	4	50	G. E. 80	K-28-J / K-28-E	Air	33″	Cast Iron
1500-1749	Brill 27-GE-2	Outside	4′ 4″	21′ 6″	4	50	G. E. 90	K-28-J	Air	33″	Cast Iron

TABLE 32—RECOMMENDED CHANGES IN SIDEWALK WIDTHS

Additional to those listed in ordinance now in force.

IMMEDIATE REDUCTIONS

Street	Street Width	From	Sidewalk Width Present	Sidewalk Width Proposed
Post	68′9″	Stockton to Leavenworth	15′	11′
Geary	68′9″	Powell to Presidio Ave.	15′	11′
O'Farrell	68′9″	Mason to Jones (cable line)	15′	12′
Powell	68′0″	Geary to Sutter (cable line)	15′	11′6″
Kearny	75′0″	Market to California	18′	14′
Kearny	75′0″	California to Broadway	18′	12′6″
Taylor	68′9″	Market to Post	15′	11′
Jones	68′9″	Market to Geary (cable line)	15′	12′
Leavenworth	68′9″	Market to Ellis	15′	11′
Montgomery	64′9″	Market to California	15′	13′*x*
Montgomery	64′9″	California to Columbus Ave.	15′	11′
Second	82′6″	Market to Mission	19′	15′
Duboce Ave.	80′0″	Church to Fillmore	19′	15′
Howard	82′6″	Ferry to Fifth Street	15′	13′*a*
Market St. Extension	90′0″	Castro to Eureka		15′
California	85′0″	Divisadero to Maple	19′*	15′

LATER REDUCTIONS

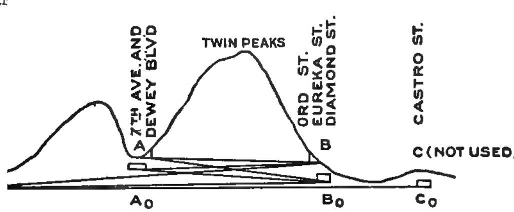
Street	Street Width	From	Sidewalk Width Present	Sidewalk Width Proposed
Columbus Ave.	80′0″	Washington to Beach	19′	15′
Guerrero	82′6″	Fourteenth St. to Twentieth	19′	15′
Stockton	66′9″	Market to Sutter	15′	10′6″
Stockton	66′9″	Sacramento to Union	15′	10′
Broadway	82′6″	Embarcadero to Mason	19′	15′
Fillmore	68′9″	McAllister to Sutter	15′	11′
Fillmore (b)	68′9″	Geary to Sutter	15′	9′
Fillmore	68′9″	Sutter to Broadway	15′	11′
Fillmore (b)	68′9″	Union to Bay	15′	9′

NOTE—Many changes authorized by ordinance have not yet been carried out of which Polk Street is a conspicuous example.

* One block, Presidio to Walnut Street, 15′.
x Sufficient for one way operation, further reduction desirable.
a Sufficient clearance for two trucks abreast.
b Arcading of store fronts is essential at terminal portals.

TU	Maximum gradient encountered on traffic route, and location
	5.3 on Broderick, California to Sacramento.
Divisadero, 82'	6.8 on Divisadero, California to Sacramento.
	6.8 on Filbert, Divisadero to Scott.
"	5.3 on Broderick, California to Sacramento.
	6.8 on Divisadero, California to Sacramento.
"	Same as above.
"	3.6 on Broderick, Pine to California.
"	2.85 on Divisadero in tunnel.
Pierce, 68'9"	6.2 on Pierce, Union to Filbert.
" "	Same as above.
" "	Same as above and on Steiner, Pine to California.
" "	6.2 on Pierce, Union to Filbert.
" "	11.1 on Steiner, Green to Union.
Steiner, 68'9"	4.2 on Steiner, Union to Filbert.
" "	4.4 on Fillmore, Bush to Pine.
Fillmore, 68'9"	4.2 on Steiner, Union to Filbert.
" "	2.5 on Steiner, Filbert to Greenwich.
" "	4.2 on Steiner, Union to Filbert.
" "	6.4 on Fillmore in tunnel, Pine to California.
" "	4.4 on Fillmore, Bush to Pine.
" "	3.4 on Bush, Steiner to Fillmore.
Broadway, 82'6	6.3 on Broadway, Powell to Stockton.

NOTES—The
Traf



Index Levels		Length Feet	Grade %	Main Grade Btweeen
A–C_0	High-L	8,500	3.26	Dewey Bvd. & Castro.
A–B	High-L	7,300	3.33	" " " Eureka.
A–B_0	"	7,700	3.61	" " " Diamond.
A–B	"	6,900	3.09	" " " Ord.
A–B_0	"	8,500	3.26	" " " Castro.
A_0–C_0	Low-Le	8,500	2.91	" " " Castro.
A_0–B	"	7,300	2.92	" " " Eureka.
A_0–B_0	"	7,700	3.22	" " " Diamond.
A_0–B	"	6,900	2.65	" " " Ord.
A_0–B_0	"	8,500	2.91	" " " Castro.
D–C_0	Low-Le	10,900	1.94	T St. & Diamond.
D–B	"	10,500	1.74	" " " Eureka.
D–B_0	"	10,900	2.0	" " " Diamond.
D–B	"	10,100	1.52	" " " Ord.
D–B_0	"	10,100	1.71	" " " Ord.
D–C_0	"	11,700	1.86	" " " Castro.

TABLE 24. SCHEDULES OPERATED BY STREET RAILWAY COMPANIES OF SAN FRANCISCO—JUNE 30, 1912

	Line and Destination by Car House Divisions	Route No. (a)	Round Trip Mileage	Dead Mileage (b)	Minutes Running Time Out	Minutes Running Time In	Minutes Lay-over Out	Minutes Lay-over In	Average Speed (m.p.h.) (c)	Range in Headway (d) Rush Hour From	Rush Hour To	Headway Min.	Mid-day From	Mid-day To	Headway Min.	Number of Trips Per Hour Rush Hour	Mid-day (e)	Number of Cars Assigned Rush Hour	Mid-day	Seating Capacity Per Car	Seats per Hour Rush Hour	Mid-day
	TURK & FILLMORE																					
1	Turk & Eddy	4	11.763	6.76	37	37	2	0.5	8.402	5:00	6:00	2½ & 3	12:00	1:00	4½	22	12.6	21	16	44	880	554
2	Fillmore & 16th	22	10.178	1.90	26	26	2	2	8.724	5:00	6:00	2 & 2½	12:00	1:00	4	26	15	28	13	42	1092	630
3	Fillmore & Valencia	23	9.184	2.06	30	30	1	2	8.610	5:00	6:00	8	12:00	1:00	10½	7.5	5.7	8	6	44	330	251
4	Fillmore Hill	41	1.224	1.90	6	6	2	1	4.896	5:00	6:00	5	12:00	1:00	5	12	12	3	3	28 & 30	348	348
5	Divisadero Extension	29	.368	2.06	4	4	0	0	2.760	5:00	6:00	8	12:00	1:00	8	7.5	7.5	1	1	28 & 30	217	217
	SUTRO																					
6	Sutter & California	1	13.672	3.12	40	40	2	2	9.118	5:00	6:00	4	12:00	1:00	7	15	8.	20	10	46	690	368
7	Sutter & Clement	2	13.716	2.76	40	40	2	2	9.144	5:00	6:00	2,2½,3,3½,4	12:00	1:00	6	20	8.6	23	11	46	690	396
8	Sutter & Jackson	3	6.478	6.94	22	22	2	2	7.621	5:00	6:00	5½	12:00	1:00	8	10.9	7.3	9	6	46	501	336
9	Mission & Richmond	24	15.012	4.47	47	47	2	5	9.378	5:00	6:00	6	12:00	1:00	9	10	6.7	16	10	42	420	281
	McALLISTER																					
10	McAllister	5	13.638	2.91	41	43	4	1	9.090	5:00	6:00	2½	12:00	1:00	3½	24	17.1	29	18	44	1056	752
11	Hayes-Ellis	21	8.930	1.11	22	22	2	2	8.502	5:00	6:00	7	12:00	1:00	7	8.6	8.6	7	7	44	377	377
	OAK & BRODERICK, AND HAIGHT																					
12	Ellis-Ocean	20	17.107	10.14	49	51	3	2	10.062	5:00	6:00	2 & 2½	12:00	1:00	5	26	12.	32	17	44	1056	528
13	Hayes	6	9.723	3.47	43	43	4	0.5	7.572	5:00	6:00	3	12:00	1:00	5½	20	10.9	27	12	46	966	501
14	Haight	7	7.882	0.00	27	27	4	0	7.882	5:00	6:00	2	12:00	1:00	3 & 3½	30	17.4	29	14	44	1188	704
15	Eighteenth Street	30	10.016	.18	32	32	5	1	11.022	5:00	6:00	5	12:00	1:00	10	12	6	13	6	28 & 30	348	174
16	Parkside	38 & 39	5.956	3.17	14	14	1	1	10.524	5:00	6:00	15	12:00	1:00	15	4	4	3	3	44	176	176
	28TH & 29TH																					
17	Valencia	9	9.112	1.50	32	32	3.5	0	8.238	5:00	6:00	2 & 2½	12:00	1:00	4½	26	13.3	32	14	44	1144	585
18	Market	8	6.676	6.36	23	23	2	0	8.010	5:00	6:00	2 & 2½	12:00	1:00	4 & 4½	27	14.1	23	14	44	1188	620
19	Mission & 24th	11	9.600	4.64	32	31	1	2	8.225	5:00	6:00	2½, 3, 4	12:00	1:00	6½	21	9.2	24	10	40 & 42	1256	377
20	Mission	18	13.434	3.84	35	35	1	3	11.190	5:00	6:00	6½	12:00	1:00	15	9.2	5.7	12	7	44	406	251
21	22nd & Howard	44	5.243	4.64	18	18	2	1	8.734	5:00	6:00	13	12:00	1:00	13	4.6	4.6	3	3	28 & 30	138	133
22	Bosworth Street	27	1.454	1.58	5	5	2½	2½	5.814	5:00	6:00	15	12:00	1:00	15	4	4	1	1	28 & 30	116	116
	GENEVA AVENUE																					
23	San Mateo	42	39.614	31.94	73	73	7	7	15.846	5:00	6:00	15	12:00	1:00	20	4	3	10	8	56	224	168
24	Cemeteries	14	21.494	11.52	55	55	7	2	10.746	5:00	6:00	7, 8 & 9	12:00	1:00	15	6	4.4	12	8	48	288	211
25	Ingleside	12	20.506	7.97	57	58	4	2	10.254	5:00	6:00	6 & 12	12:00	1:00	15	8	4.4	15	10	44 & 40	352	185
26	Guerrero	26	16.014	2.76	49	49	4	2	9.608	5:00	6:00	6 & 12	12:00	1:00	13	8	4.6	13	8	42	336	193
27	Glen Park	10	13.000	4.07	43	43	3	2	8.478	5:00	6:00	6 & 12	12:00	1:00	13	7	4.6	11	7	42	294	193
28	South City	55	8.500	11.52	25	25	5	5	8.500	5:00	6:00	25	12:00	1:00	30	2.4	2	2	2	44	105	88
29	Visitacion	46	4.588	2.34	13	13	2	2	9.176	5:00	6:00	15	12:00	1:00	15	4	4	2	2	28 & 30	116	116
	24TH STREET																					
30	Howard	35	8.796	0.00	28	28	2	2	8.796	5:00	6:00	5 & 6½	12:00	1:00	8 & 8½	12	7.3	12	8	44	406	321
31	Folsom	33	8.024	1.82	28	28	2	2	8.024	5:00	6:00	5 & 4	12:00	1:00	8 & 8½	12	7.3	12	7	40 & 44	620	307
32	Bryant	28	7.624	1.91	26	26	2	2	7.624	5:00	6:00	4 & 7	12:00	1:00	8	11.6	7.5	15	7	42	486	315
33	9th & Polk	19	5.002	3.25	21	21	2	2	7.648	5:00	6:00	3½	12:00	1:00	5	17.2	12	13	8	44	754	528
34	San Bruno	25	10.620	4.94	35	35	1	1	8.382	5:00	6:00	8 & 9	12:00	1:00	14	7.5	4.3	9	5	42 & 44	287	185
35	10th & Montgomery	37	5.582	2.93	23	23	1	1	6.978	5:00	6:00	6	12:00	1:00	6	10	10.	8	8	28 & 30	290	290
36	6th & Sansome	43	5.716	4.05	25	25	1	1	7.154	5:00	6:00	6½	12:00	1:00	6½	9.2	9.2	8	7	28 & 30	267	267
	KENTUCKY																					
37	Kearny & Broadway	17	....	....	15	15	1	1	......	5:00	6:00	8	12:00	1:00	8	7.5	7.5	8	8	42	315	315
38	Kearny & Beach	15	5.275	3.57	23	23	1	1	6.588	5:00	6:00	4	12:00	1:00	4	15	15	12	12	42	630	630
39	Kentucky	16	13.150	4.83	45	45	1	5	8.214	5:00	6:00	7 & 8	12:00	1:00	8	7.5	7.5	13	12	44 & 42	324	322
40	8th & 18th	31	9.500	3.20	27	27	1	1	9.500	5:00	6:00	6	12:00	1:00	8	10	7.5	10	6	42 & 44	430	322
41	Railroad Avenue	40	3.382	4.83	8	8	2	2	10.146	5:00	6:00	10	12:00	1:00	10	6	6	2	2	28 & 30	174	174
42	Harrison	34	3.316	3.57	12½	12½	1½	1	7.104	5:00	6:00	5½	12:00	1:00	5½	10.9	9.6	5	4	28 & 30	248	248
43	1st & 5th	32	5.564	3.57	20	19	1	1	7.944	5:00	6:00	14	12:00	1:00	14	4.3	4.3	3	3	28 & 30	124	124
	TOTAL ELECTRIC								8.678							527.4	351.2	559	337		21653	14130
	WASHINGTON & MASON																					
44	Powell	53	3.217	1.624	14	14	2	2	6.031	5:00	6:00	4, 4½ & 5	12:00	1:00	6½	14	9.2	7	5	28	392	258
45	Sacramento	54	4.556	1.342	18	18	3	1	6.834	5:00	6:00	4	12:00	1:00	5	15	12	10	8	36	540	432
46	Jackson	51	4.462	2.748	18	18	2	2	6.372	5:00	6:00	3	12:00	1:00	5	20	12	14	8	28	560	336
47	Pacific Avenue	52	2.286	0.00	9	9	1	1	6.858	5:00	6:00	5	12:00	1:00	6⅔	12	9	4	3	36	432	324
	28TH STREET																					
48	Castro	48	1.786	0.00	7	7	1	3	6.123	5:00	6:00	3½ & 4	12:00	1:00	6	17	10	5	3	36	612	360
	TOTAL CABLE								6.445							78	52.2	40	27		2536	1710
	TOTAL, ELECTRIC AND CABLE (U. R. R.)								8.529							605.4	403.4	599	364		24189	15840
49	PRESIDIO & FERRIES	45	7.63	....	30	29	3	2	7.76	4:30	6:30	3¼	10:30	1:30	4	20	15	20	15	28	560	420
	CALIFORNIA STREET CABLE																					
50	California	47	....	....	20	18	5	3	......	4:20	6:20	2½	12:00	1:00	3	24	20	18	..	34	816	680
51	Hyde-O'Farrell(g)	50	....	....	16	19	6	3	......	4:25	6:20	2½	12:00	1:00	3¼	24	18.5	16	..	24	576	444
52	GEARY (CABLE)	49	7.67	....	30	30	7	3	7.67	5:00	6:00	3	12:00	1:00	4	20	15	22	..	39	780	585

Size of Class or Cars Assigned by Routes (f)

	Line and Destination	Electric Cars A 46	B 44	C 40	D 42	E 48	F 42	G 44	H 44	I 56	J 44	K 44	L 28	Cable Cars X 36	Y 36	Z 28	
1	Turk & Eddy								21								1
2	Fillmore & 16th						28										2
3	Fillmore & Valencia								8								3
4	Fillmore Hill												3				4
5	Divisadero Extension												1				5
6	Sutter & California	20															6
7	Sutter & Clement	23															7
8	Sutter & Jackson	9															8
9	Mission & Richmond						16										9
10	McAllister							29									10
11	Hayes-Ellis							7									11
12	Ellis-Ocean								32								12
13	Hayes	27															13
14	Haight								29								14
15	Eighteenth Street												13				15
16	Parkside		3														16
17	Valencia								32								17
18	Market								23								18
19	Mission & 24th			2	22												19
20	Mission								12								20
21	22nd & Howard												3				21
22	Bosworth Street												1				22
23	San Mateo									10							23
24	Cemeteries					12											24
25	Ingleside								13			2					25
26	Guerrero						13										26
27	Glen Park						11										27
28	South City		2														28
29	Visitacion												2				29
30	Howard								12								30
31	Folsom			10					2								31
32	Bryant						15										32
33	9th & Polk							13									33
34	San Bruno						4				5						34
35	10th & Montgomery												8				35
36	6th & Sansome												8				36
37	Kearny & Broadway						8										37
38	Kearny & Beach						12										38
39	Kentucky		12				1										39
40	8th & 18th						3				7						40
41	Railroad Avenue												2				41
42	Harrison												5				42
43	1st & 5th												3				43
44	Powell															7	44
45	Sacramento														10		45
46	Jackson															14	46
47	Pacific Avenue													4			47
48	Castro														5		48
49	PRESIDIO & FERRIES												20				49
50	California														18		50
51	Hyde-O'Farrell(g)														16		51
52	GEARY (CABLE)														22		52

KEY TO CLASS OF ELECTRIC CARS

Index	Numbers	Type
A	101 to 180	Closed P. A. Y. E.
B	681 to 698	California.
C	731 to 745	California.
D	1001 to 1024	California.
E	1225 to 1244	Closed.
F	1301 to 1425	California.
G	1500 to 1549	Closed P. A. Y. E.
H	1550 to 1749	Closed (partly P. A. Y. E.)
I	1 to 12	Interurban closed.
J	900 to 1000	California.
	1100 to 1200	California.
K	700	Rebuilt California, P. A. Y. E.
L		California, single truck.

KEY TO CLASS OF CABLE CARS

X	Dummy and trailer.
Y	Double truck; two open and one closed section.
Z	Double truck; one open and one closed section.

(a) Route Nos. established by the Company up to No. 26, thence numbered consecutively and applying to all records herein.
(b) Includes both revenue and non-revenue dead mileage.
(c) Average speed figured on car hour basis.
(d) From inner terminus.
(e) Approximate: estimated from headway.
(f) Numbers immediately below class-letters indicate number of seats per car.
(g) Two cars run shuttle service on Jones Street—headway three minutes.

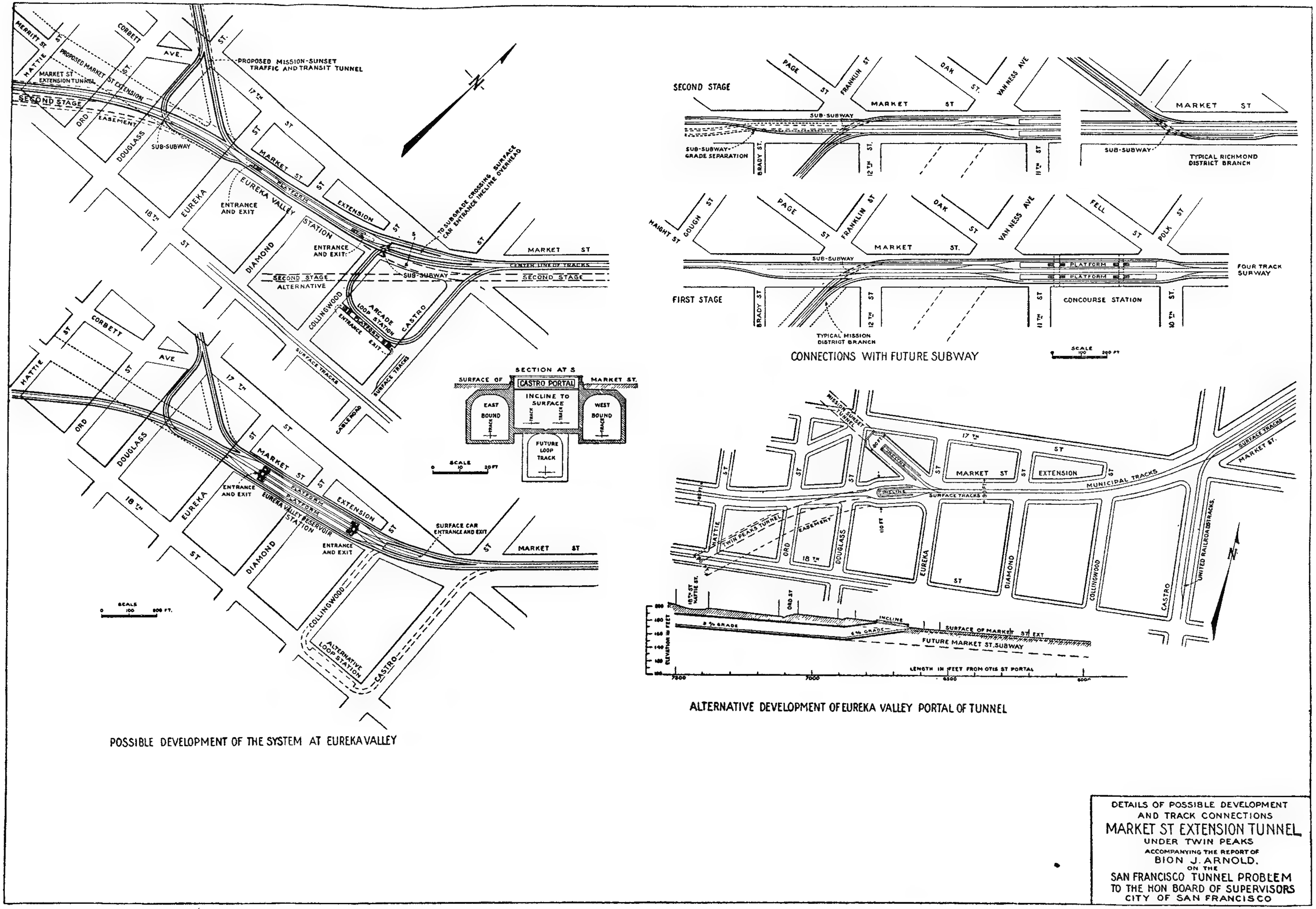


PLATE 16.—ALTERNATIVE PLAN AND DETAILS OF MARKET STREET EXTENSION TUNNEL.

Alternative development. Plan and profile for present tunnel construction terminating at Eureka Street, with possible surface track connections, showing outlet of tunnel to four tracks in upper Market Street. This involves the contour extension of Market Street now, with a possible further extension out of Eureka Valley.

Details of future extensions and developments, showing provision for four-track express bore—Project B, track connections into a future four-track subway in lower Market Street, typical branch connections to the Mission and Western Addition, local return loop at Castro Street, and subway connections to Mission-Sunset tunnel.

TABLE 34.

AUTHORIZED AND OUTSTANDING SECURITIES

UNITED RAILROADS (AS OF JUNE 30, 1912)

FIRST PREFERRED STOCK			
Authorized		$5,000,000.00	
Outstanding			$5,000,000.0
PREFERRED STOCK			
Authorized		$20,000,000.00	
Outstanding			$20,000,000.00
COMMON STOCK			
Authorized		$20,000,000.00	
Reduced (1908)	$1,200,000.00		
In Treasury	851,400.00		
Unissued		2,051,400.00	
			$17,948,600.00
TOTAL STOCK OUTSTANDING			$42,948,600.00
MORTGAGE BONDS—U. R. R. 4 PER CENT			
Authorized		$35,275,000.00	
Reserve for Underlying Securities	$9,866,000.00		
In Treasury from Issue of $5,409,000. for Additions and Betterments	75,000.00		
Unissued		9,941,000.00	
Outstanding		$25,334,000.00	
UNDERLYING BONDS—Total All Subsidary Companies			
Authorized	$25,450,000.00		
Outstanding		14,591,000.00	
TOTAL BONDS OUTSTANDING			$39,925,000.00
GOLD NOTES—5 PER CENT			
Authorized	$1,000,000.00		
Outstanding		$1,000,000.00	
INCOME NOTES—6 PER CENT			
Authorized	$1,229,000.00		
Outstanding		$1,229,000.00	
EQUIPMENT NOTES			
Authorized	$400,000.00		
Outstanding		$300,000.00	
TOTAL OTHER DEBT			$2,529,000.00
TOTAL			$85,402,600.00

RECONCILIATION WITH CAPITAL INVESTMENT SCHEDULE

Net Capital Investment	$80,835,542.97	
Bonds and Sinking Fund Investment	4,267,057.03	
		$85,102,600.00
Equipment Trust		300,000.00
		$85,402,600.00

Authority—United Railroads Balance Sheet.

TABLE 35.—STATEMENT OF BONDED AND OTHER DEBT

UNITED RAILROADS (AS OF JUNE 30, 1912)

BONDED DEBT	Amount Authorized	Amount Outstanding	Annual Interest	Date Due	Sinking Fund Requirement	Sinking Fund Credit
UNITED RAILROADS General First Sinking Fund 4's, 25 Year	$35,275,000**	$25,334,000	$1,013,360	April 1, 1927	All income over 5% on Common must be applied. 2% of gross earnings with minimum of $100,000 per annum.	$1,263,717.13
PARK & OCEAN RAILROAD First Gold 6's, 30 Year	250,000	250,000	15,000	Jan. 1, 1914	$4,000 per year, commencing year 1890.	136,103.07
MARKET STREET CABLE RY. First Gold 6's, 30 Year	3,000,000	3,000,000	180,000	Jan. 1, 1913	$40,000 per year, commencing year 1893.	1,101,966.85
OMNIBUS CABLE CO. First Gold 6's, 30 Year	2,000,000	2,000,000	120,000	April 2, 1918	2% am't bonds issued and outstanding for 5 years commencing 1898; 4% for 5-year period from 1903; 6% for 5-year period from 1908; 8% from 1913 to maturity.	1,450,194.24
SUTTER STREET RAILWAY First Gold 5's, 30 Year	1,000,000	1,000,000	50,000	May 1, 1918	$50,000 per annum commencing May 1, 1908, to maturity.	315,636.39
PARK & CLIFF HOUSE RY. First 6's, 25 Year	350,000	350,000	21,000	Jan. 1, 1913	Reserve Fund U. R. R. 4's.	....
FERRIES & CLIFF HOUSE RY. First 6's, 25 Year	650,000	650,000	39,000	Mar. 1, 1914	Reserve Fund U. R. R. 4's.	....
MARKET STREET RY. Consolidated Gold 5's, 30 Year	17,500,000	7,341,000	367,050	Sept. 1, 1924	$160,000 per annum *commencing Sept. 1. 1918.*	....
Total		$39,925,000	$1,805,410			$4,267,617.68
OTHER DEBTS						
EQUIPMENT TRUST CERTIFICATES Gold 6's	400,000	300,000	18,000		$50,000 per annum from July 15, 1911 to July 15, 1918.	
PROMISSORY NOTES, 5% Dated 1906; subject to call after 5 years at par	1,000,000	1,000,000	50,000	Feb. 1, 1915		
INCOME NOTES, 6%	1,229,000	1,229,000	73,740			
Total (Bonded & Other Debt)		$42,454,000	$1,947,150			

TABLE 36—CAPITAL INVESTMENT

UNITED RAILROADS (AS OF JUNE 30, 1912)

CAPITAL STOCK		
First Preferred	$ 5,000,000.00	
Preferred	20,000,000.00	
Common (less $851,400 in Treasury)	17,948,600.00	
Total Stock		$42,948,600.00
FUNDED DEBT	$40,000,000.00	
GOLD NOTES, 5%	1,000,000.00	
INCOME NOTES, 6%	1,229,000.00	
Total Gross Debt	$42,229,000.00	
LESS		
BONDS IN TREASURY	$75,000.00	
MORTGAGE SINKING FUND INVESTMENTS	4,109,780.46	
BOND AND STOCK INVESTMENT	157,276.57	
	$4,342,057.03	$37,886,942.97
NET CAPITAL INVESTMENT, 1912		$80,835,542.97
Investment per mile track owned		320,800.00
NET CAPITAL INVESTMENT, 1902		72,437,357.00
Investment per mile track owned		308,500.00

Authority—United Railroads Balance Sheets.

TABLE 37—SUMMARY OF BOND DISCOUNTS AND PREMIUMS

UNITED RAILROADS OF SAN FRANCISCO

U. R. R. 4 per cent issued to acquire stock of underlying companies, 1902.		
Bonds issued		$20,000,000.00
Discount		none
U. R. R. 4 per cent sold for "Betterments, Improvements, Acquisitions."		
Bonds sold, 1906-1909		$5,334,000.00
Discount		1,420,890.89
Average rate		26.64%

DETAIL OF DISCOUNTS

1906	$236,888.88
1907	476,807.17
1908	329,954.90
1909	377,239.94
	$1,420,890.89

UNDERLYING COMPANIES

Market Street Railway 5 per cent	
Bonds Sold, 1906-1907	$1,500,000.00
Premiums	100,941.23
Average Rate	6.72%

DETAIL OF PREMIUMS

1906	$27,775.99
1907	73,165.24
	$100,941.23

Authority—Data furnished by United Railroads.

Table 38

TABLE 38.—STATEMENT OF SINKING FUNDS

Year Ending December 31st	1905	1906	1907	1908	1909	1910	1911	1912 (June 30)
UNITED RAILROADS								
General First Sinking Fund 4's, 25 year.								
Uninvested Balance	$142,159.56	$130,167.78	$110,021.89	$267,347.94	$393,643.25	$176,233.28	$271,654.96	$162,783.13
Total Investments	136,144.46	276,895.08	413,597.98	413,597.98	456,421.98	857,279.76	965,815.25	1,100,934.00
Total Credit	278,304.02	407,062.86	523,619.87	680,945.92	850,065.23	1,033,513.04	1,237,470.21	1,263,717.13
PARK & OCEAN R. R. COMPANY								
First Gold 6's, 30 year.								
Uninvested Balance	4,690.34	7,530.25	16,270.25	17,912.26	26,975.78	6,579.30	19,337.95	
Total Investments	84,659.61	89,871.92	89,405.25	95,866.53	95,866.53	113,531.28	111,907.41	
Total Credit	89,349.95	97,402.17	105,675.50	113,778.79	122,842.31	120,110.58	131,245.36	136,098.61
MARKET STREET CABLE COMPANY								
First Gold 6's, 30 year.								
Uninvested Balance	40,232.37	62,932.69	113,167.69	121,075.78	203,624.75	60,948.94	139,023.44	
Total Investments	638,329.85	686,848.25	709,479.92	771,504.36	769,103.47	907,914.33	926,103.18	
Total Credit	678,562.22	749,780.94	822,647.61	892,580.14	972,728.22	968,863.27	1,065,126.62	1,101,970.69
OMNIBUS CABLE COMPANY								
First Gold 6's, 30 year.								
Uninvested Balance	601.73	102,011.03	104,730.76	76,770.14	238,782.23	62,351.50	247,064.97	
Total Investments	506,293.39	508,899.56	610,386.23	785,823.77	785,623.77	1,039,839.54	1,039,839.54	
Total Credit	506,895.12	610,910.59	715,116.99	862,593.91	1,024,406.00	1,102,191.04	1,286,904.51	1,450,103.70
SUTTER STREET RAILWAY COMPANY								
First Gold 5's, 30 year.								
Uninvested Balance						2,420.00	61,840.00	
Total Investments				50,000.00	100,000.00	149,150.00	149,150.00	
Total Credit				50,000.00	100,000.00	151,570.00	210,990.00	315,686.39

Authority—Records of United Railroads.

TABLE 39.—BETTERMENT ACCOUNT 1902–1912

UNITED RAILROADS

ADDITIONS AND BETTERMENTS TO PROPERTY
(MINOR CREDITS DEDUCTED)

1902	$1,125,516.13	
1903	1,431,225.81	
1904	522,335.75	
1905	724,633.42	
1906	2,823,615.81	
1907	3,483,924.29	
1908	833,809.93	
1909	824,008.01	
1910	196,322.86	
1911	237,970.85	
1912	71,473.59	
		$12,274,836.45
CREDITS		
North Beach Power Station	$420,000.00	
North Beach Power Station Loss	503,569.63	
Turk and Fillmore Sub-Station Equipment	115,610.40	
Geneva Sub-Station Equipment	37,660.54	
Millbrae Sub-Station Equipment	18,833.63	
Sundries	47,880.29	
		1,143,554.49
Net, June 30, 1912, including bond discounts		$11,131,281.99
BOND DISCOUNTS		
1906	$236,888.88	
1907	476,807.17	
1908	329,954.90	
1909	377,239.94	
		1,420,890.89
		$9,710,391.07
Plus Premium		100,941.23
Total Net		$9,811,332.30

Authority—Data furnished by United Railroads.

Table 40

TABLE 40.—DIVIDENDS

UNITED RAILROADS

Date Paid	Rate %	Amount	Totals
FIRST PREFERRED			
July 15, 1908	3.5	$175,000	
Feb. 15, 1909	3.5	175,000	
July 15, 1909	3.5	175,000	
Feb. 15, 1910	3.5	175,000	
July 15. 1910	3.5	175,000	
Feb. 15, 1911	3.5	175,000	
July 15, 1911	3.5	175,000	
			$1,225,000
PREFERRED			
Dec., 1902	1.2	240,000	
June, 1903	1.2	240,000	
Dec., 1903	1.2	240,000	
June, 1904	1.5	300,000	
Dec., 1904	1.5	300,000	
June, 1905	1.8	360,000	
Dec., 1905	2.0	400,000	
Mar. 1906	3.6	720,000	
Dec., 1906	2.0	400,000	
			3,200,000
COMMON			
Mar., 1906	1.5	300,000	300,000
TOTAL DIVIDENDS			$4,725,000

Authority—Data furnished by United Railroads.

ME—UNITED RAILROADS

		1904			1905		
	%		%	%		%	%
00	100.00	$6,683,300.59	100.00	100.00	$7,102,528.06	100.00	100.00
60		6,652,630.27	99.54		7,066,891.94	99.50	
75		6,591,842.85	98.60		7,000,343.39	98.60	
40		30,670.32	0.46		35,636.12	0.50	
)0	11.06	827,060.97	100.00	12.38	813,799.70	100.00	11.45
)0	5.64	382,611.94	46.25	5.73	473,058.99	58.13	6.66
56		171,738.34	20.76		243,897.72	29.95	
)0	5.42	444,449.03	53.75	6.65	340,740.71	41.87	4.80
30		360,325.11	43.58		282,154.49	34.68	
)0	33.33	2,092,722.81	100.00	31.30	2,029,676.75	100.00	28.57
50	6.86	396,188.73	18.93	5.93	361,460.95	17.82	5.09
10		1,696,534.08	81.07		1,668,215.80	82.18	
50	22.52	1,418,886.49	67.75	21.24	1,380,810.51	68.00	19.45
)0	7.51	379,954.63	100.00	5.68	385,464.61	100.00	5.43
6	2.39	132,710.28	34.90	1.99	132,713.55	34.42	1.87
9		42,672.74	11.23		62,398.98	16.18	
	51.90	3,299,738.41		49.36	3,228,941.06		45.45
	6.53	376,700.00		5.64	388,879.91		5.48
	58.43	3,676,438.41		55.00	3,617,820.97		50.93
	2.32	410,692.16(*a*)		6.14	353,344.60		4.98
	60.75	4,087,130.57		61.14	3,971,165.57		55.91
	39.25	2,596,170.02		38.86	3,131,362.49		44.09
	0.20	71,710.20(*b*)		1.07	7,838.89		0.11
	24.32	1,524,050.00		22.82	1,524,050.00		21.46
	14.73	1,000,409.82		14.97	1,599,473.60		22.52
	1.98	257,052.59		3.85	265,337.84		3.74
	12.75	743,357.23		11.12	1,334,135.76		18.78

		1910			1911		
	%		%	%		%	%
0	100.00	$7,740,659.91	100.00	100.00	$7,966,987.32	100.00	100.00
1		7,653,489.15	98.87		7,886,136.08	98.98	
4		7,605,489.15	98.25		7,836,136.08	98.36	
9		87,170.76	1.13		80,851.24	1.02	
0	13.85	978,144.20	100.00	12.63	904,608.77	100.00	11.36
8	4.32	344,758.28	35.25	4.45	368,612.75	40.75	4.63
2		282,656.18	28.90		294,243.81	32.52	3.70
2	9.53	633,385.92	64.75	8.18	535,996.02	59.25	6.73
0		545,812.87	55.80		452,396.47	50.00	
0	35.71	2,770,211.88	100.00	35.79	2,798,315.68	100.00	35.12
0	13.93	1,051,509.90	37.95	13.59	1,034,352.74	36.96	12.98
0		1,718,701.98	62.05		1,763,962.94	63.00	
0	17.60	1,358,984.95	49.05	17.56	1,407,603.01	50.30	17.67
0	6.83	532,814.48	100.00	6.88	600,026.53	100.00	7.54
5	2.99	238,323.22	44.72	3.08	267,075.94	44.50	3.35
3		49,122.57	9.22		76,075.66	12.68	
	56.39	4,281,170.56		55.30	4,302,970.98		54.02
	5.27	448,100.00		5.79	404,000.00		5.07
	61.66	4,729,270.56		61.09	4,706,970.98		59.09
	2.09	458,959.35(*d*)		5.93	473,168.16(*d*)		5.94
	63.75	5,188,229.91		67.02	5,180,139.14		65.03
	36.25	2,552,430.00		32.98	2,786,848.18		34.97
	1.54	180,000.22		2.33	136,687.76		1.71
	24.50	1,862,410.00		24.06	1,958,525.00		24.58
	10.21	510,019.78		6.59	691,635.42		8.68
	4.83	367,069.78		4.74	371,722.72		4.67
	5.38	142,950.00		1.85	319,912.70		4.01

Loss in Capital Account, not against Income Account.
20 1902. Data for previous years comprise railways which subsequently became

... basis by eliminating "interest on bond and sinking

TABLE 25—SUMMARY TRAFFIC COUNTS BY INDIVIDUAL CAR TRIPS—OUTBOUND FROM LOADING DISTRICT

ROUTE	Turk and Eddy	McAllister	Hayes	Haight	Market	Valencia	9th and Polk	San Mateo
OBSERVATIONS								
Car Numbers	1632	1549	180	1620	1606	1616	1521	2
Duration (start) P. M.	5-06'-10"	5-02'-30"	4-59 -30"	4-56'-25"	4-58'-40"	4-58'-40"	4-51'-30"	5-01'-00"
Duration (end) P. M.	5-38'-26"	5-48'-00"	5-38'-00"	5-29'-20"	5-23'-55"	5-34'-40"	5-12'-50"	5-43'-05"
Off time leaving	*	0	*	*	37" L.	1' 10" L.	1' L.	1' L.
Off time arriving	*	*	*	*	*	*	*	*
Distance in Miles, one way	4.634	6.819	4.861	3.941	3.335	4.556	2.501	6.266
Number of Stops	48	56	48	35	24	39	32	37
Passengers On	182	152	147	126	177	181	113	155
Passengers Off	187	146	151	129	177	178	115	149
Cash Fares	89	105	114	98	135	136	39	111
Transfers	0	47	33	28	41	45	74	44
Tickets	2	0	0	0	0	0	0	0
Free Rides	0	0	0	0	1	0	0	0
Total Fares	182	152	147	126	177	181	113	155
Seating Capacity	44	44	46	44	44	44	44	56
Total Time of Stops	5' 37"	5' 34"	5' 17"	4' 38"	6' 23"	6' 27"	4' 42"	5' 53"
Weather Conditions	Good	Good	Good	Good	Moderate	Good	Good	Good
RESULTS								
Maximum Load	94	93	101	104	129	129	64	120
% Maximum Load to Total Fares	51.6	61.1	68.7	82.6	72.9	71.2	56.6	77.4
% Maximum Load to Seating Capacity	213.6	211.3	219.0	236.4	293.0	293.0	145.3	214.2
Average Length of Ride (Miles)	1.71	1.98	1.86	1.72	1.9	2.22	0.86	2.81
Schedule Speed (Miles per Hour)	8.402	9.09	7.572	7.882	8.01	8.238	7.648	15.846
Average Speed (Actual)	8.61	8.99	7.58	7.1	7.93	7.59	6.91	9.04
Average Speed (less Stops)	10.4	10.22	8.79	8.3	10.61	9.28	9.0	10.4
Average Speed Outside Congested Districts	8.61	10.9	8.8	8.47	11.1	9.44	7.5	11.2
Stops per Mile (Average)	10.38	8.1	9.87	8.88	7.19	8.55	12.8	5.91
Distance Between Stops (Average feet)	508.6	652	535	595	736	618	412	894
Average Length of Stops (Seconds)	70	5.96	6.6	7.94	15.96	9.93	8.81	9.55
% Time of Stops (to Elapsed Time)	17.4	12.23	13.65	14.05	25.3	18.4	20.2	14.02
% Average Passenger Ride to Car Haul	36.9	29.0	38.3	43.6	57.0	48.6	34.4	44.8
Origin of Route	Powell & Eddy	Ferry	Ferry	Ferry	Ferry	Ferry	9th & Brannan	5th & Market
Actual Load compared with typical rush hour loading — High	81% High	10% High			9% High	20% High		Average
Actual Load compared with typical rush hour loading — Low			8% Low	7% Low			9% Low	
Comparison of typical loading, morning with evening rush hours — High	22% Higher							
Comparison of typical loading, morning with evening rush hours — Low		5% Lower	30% Lower	9% Lower	40% Lower	10% Lower	9% Lower	33% Lower
Distance of Maximum Load Point from origin of Route in Miles	2.61	1.6	1.75	1.68	1.34	1.34	1.04	1.87
Date	Apr. 19, 1912	Apr. 16, 1912	Apr. 23, 1912	Apr. 22, 1912	Apr. 17, 1912	Apr. 17, 1912	Apr. 22, 1912	Apr. 18, 1912

ROUTE	Sutter and California	Sutter and Clement	Sutter and Jackson	Ellis and Ocean	Hayes and Ellis	9th and Polk	Fillmore and 16th St. to 23rd	Fillmore and Valencia	Guerrero Ocean Vi
OBSERVATIONS									
Car Numbers	140	117	152	1626	1526	1511	1305	1653	1352
Duration (start) P. M.	5-10'-00"	4-51'-27"	5-25'-30"	5-03'-50"	5-09'-45"	4-58'-00"	5-10'-31"	5-37'-18"	5-04'-07
Duration (end) P. M.	5-47'-40"	5-34'-42"	5-52'-00"	5-54'-05"	5-34'-30"	5-20'-55"	5-50'-50"	6-04'-08"	5-57'-07
Off time leaving	*	1' 27" L.	1' 7" L.	10" F.	45" L.	30" L.	31" L.	5' 18" L.	53" F.
Off time arriving	*	*	*	*	*	*	*	*	*
Distance in Miles, one way	6.836	6.858	3.239	8.553	4.465	2.501	5.09	4.592	8.01
Number of Stops	51	68	39	60	38	32	51	35	52
Passengers On	145	156	137	178	42	139	242	70	171
Passengers Off	132	161	137	174	45	141	244	68	175
Cash Fares	93	77	86	121	32	42	139	38	104
Transfers	52	79	51	57	10	97	103	32	67
Tickets	0	0	0	0	0	0	0	0	0
Free Rides	0	0	0	0	0	0	0	0	0
Total Fares	145	156	137	178	42	139	242	70	171
Seating Capacity	46	46	46	44	44	44	42	44	42
Total Time of Stops	*	*	*	*	*	7' 9"	9' 30"	3' 42"	5' 49"
Weather Conditions	Good	Good	Good	Good	Good	Good	Good	Good	Good
RESULTS									
Maximum Load	100	91	93	86	33	83	105	48	107
% Maximum Load to Total Fares	69.0	58.3	67.8	48.3	78.6	59.7	43.4	68.6	62.6
% Maximum Load to Seating Capacity	217.2	197.5	202.2	195.3	75.0	188.5	250.0	109.1	254.5
Average Length of Ride (Miles)	2.45	2.03	1.5	1.64	1.7	0.92	1.55	1.63	2.3
Schedule Speed (Miles per Hour)	9.118	9.144	7.621	10.062	8.502	7.648	8.724	8.61	9.60
Average Speed (Actual)	8.35	9.51	7.26	10.22	9.2	6.53	7.57	10.2	8.71
Average Speed (less Stops)						9.36	11.57	10.15	9.29
Average Speed Outside Congested Districts	9.68	9.65	7.77	11.02	8.502	7.648	7.57	12.7	9.5
Stops per Mile (Average)	7.46	9.91	12.0	7.01	8.5	13.0	10.0	7.63	6.49
Distance Between Stops (Average feet)	708	533	440	753	622	407	528	693	815
Average Length of Stops (Seconds)						7.46	11.2	6.35	6.7
% Time of Stops (to Elapsed Time)						31.2	23.5	13.86	10.15
% Average Passenger Ride to Car Haul	35.8	29.6	46.3	19.2	38.0	36.8	30.4	35.5	28.7
Origin of Route	Sutter-Sansome	Sutter-Sansome	Sutter-Sansome	3rd and Townsend	Stockton-Ellis	9th and Brannan	23rd & Kentucky	Richland-Mission	Ferry
Actual Load compared with typical rush hour loading — High	Average	13% High	Average	5% High		10% High	5% High		8% Hig
Actual Load compared with typical rush hour loading — Low					50% Low			15% Low	
Comparison of typical loading, morning with evening rush hours — High						*	*	25% Higher	
Comparison of typical loading, morning with evening rush hours — Low	12% Lower	8% Lower	70% Lower	10% Lower	20% Lower				30% Low
Distance of Maximum Load Point from origin of Route in Miles	0.42	0.43	0.43	1.5	0.58	1.64	2.29	2.72	1.75
Date	Apr. 11, 1912	Apr. 11, 1912	Apr. 10, 1912	Apr. 16, 1912	Apr. 10, 1912	May 1, 1912	Apr. 29, 1912	Apr. 24, 1912	Apr. 25, 1

* Observations not made. † Passengers remaining on car at County Line not counted.

ROM LOADING DISTRICT

s and llis	9th and Polk	Fillmore and 16th St. to 23rd	Fillmore and Valencia	Guerrero and Ocean View	Cemeteries to County Line	24th and Mission	Sunnyside and Glen Park	Fillmore and 16th to Bryant	Mission and Richmond	Powell and Mason
526	1511	1305	1653	1352	1234	1005	1370	1304	1338	515
'-45"	4-58'-00"	5-10'-31"	5-37'-18"	5-04'-07"	4-58'-44"	5-09'-55"	5-00'-55"	5-01'-48"	5-12'-02"	5-10'-15"
'-30"	5-20'-55"	5-50'-50"	6-04'-08"	5-57'-07"	5-47'-14"	5-45'-20"	5-53'-20"	5-29'-43"	6-01'-57"	5-24'-00"
" L.	30" L.	31" L.	5' 18" L.	53" F.	16" F.	5" F.	1' 5" F.	42" F.	1' 2" L.	45" F
*	*	*	*	*	*	*	*	*	*	*
465	2.501	5.09	4.592	8.01	7.43	4.8	6.5	3.094	7.5	1.608
38	32	51	35	52	51	37	51	37	64	18
42	139	242	70	171	232	141	156	230	148	50
45	141	244	68	175	184†	135	148	215	136	48
32	42	139	38	104	145	94	103	178	80	23
10	97	103	32	67	87	47	53	52	68	27
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
42	139	242	70	171	232	141	156	230	148	50
44	44	42	44	42	48	42	42	42	42	28
*	7' 9"	9' 30"	3' 42"	5' 49"	9' 45"	4' 21"	9' 34"	8' 14"	8' 2"	1' 58"
ood	Good	Good	Good	Good	Good	Good	Fair	Good	Fair	Good
3	83	105	48	107	119	99	113	104	80	42
.6	59.7	43.4	68.6	62.6	51.2	70.1	72.4	45.2	54.0	84.0
.0	188.5	250.0	109.1	254.5	247.8	235.5	269.0	247.5	190.4	150.0
.7	0.92	1.55	1.63	2.3	3.14	2.27	2.8	0.73	1.85	0.691
.502	7.648	8.724	8.61	9.608	10.746	8.225	8.478	8.724	9.378	6.031
.2	6.53	7.57	10.2	8.71	9.0	8.16	7.44	6.68	9.02	7.02
	9.36	11.57	10.15	9.29	10.2	9.28	9.1	9.4	10.74	8.2
.502	7.648	7.57	12.7	9.5	10.0	8.16	8.41	8.9	10.4	7.08
.5	13.0	10.0	7.63	6.49	6.86	7.71	7.85	11.9	8.53	11.19
	407	528	693	815	771	685	673	444	620	472
	7.46	11.2	6.35	6.7	11.5	7.05	11.25	13.3	7.53	6.56
	31.2	23.5	13.86	10.15	17.93	12.23	18.18	29.6	16.1	14.31
.0	36.8	30.4	35.5	28.7	42.2	47.3	43.1	23.6	24.7	43.0
on-Ellis	9th and Brannan	23rd & Kentucky	Richland-Mission	Ferry	Ferry	Ferry	Ferry	16th and Bryant	Banks-Courtland	Powell-Eddy
	10% High	5% High		8% High	24% High		Average	Average	Average	
Low	*	*	15% Low			7% Low				4% Low
Lower			25% Higher	30% Lower	4% Lower	7% Lower	23% Lower	4% Lower	45% Lower	30% Lower
58	1.64	2.29	2.72	1.75	2.64	1.82	2.92	0.36	2.99	0.23
, 1912	May 1, 1912	Apr. 29, 1912	Apr. 24, 1912	Apr. 25, 1912	Apr. 25, 1912	Apr. 26, 1912	Apr. 26, 1912	Apr. 24, 1912	Apr. 29, 1912	Apr. 30, 1912

PLATE 17.—EFFECT OF TWIN PEAKS TUNNEL ON LOCAL RUNNING TIME

Contour map of San Francisco, showing time zones resulting from local operation through the tunnel as compared with the time zones of present lines. Shaded areas indicate slopes greater than 10% and 25%, respectively, for the area affected by this project. White lines indicate Market Street extension boulevard, and the suggested Seventh Avenue connecting boulevard down the Peninsula and to the beach. Note that only one half of the city lies within the present 30-minute zone and that the tunnel extends this zone nearly to the beach.

TABLE 25---SUMMARY TRAFFIC COUNTS BY INDIVIDUAL CAR TRIPS---OUTBOUND FROM LOADING DISTRICT---Continued.

ROUTE	Powell and Jackson	Kearny and Beach	Kentucky	Folsom	Bryant	Eighth and Eighteenth	Geary (Cable)	Mission	Sacramento
OBSERVATIONS									
Car Numbers	519	1414	1423	1739	1384	693	14	1569	15
Duration (start) P. M.	5–12′–17″	4–52′–25″	4–51′–59″	5–03′–25″	5–07′–40″	5–05′–09″	5–07′–50″	5–08′–25″	5–05′–17″
Duration (end) P. M.	5–33′–00″	5–16′–27″	5–45′–24″	5–32′–15″	5–35′–45″	5–34′–00″	5–39′–00″	5–51′–40″	5–23′–37″
Off time leaving	13″ F.	15″ L.	0	35″ F.	20″ F.	17′ 9″ L.	1′ 10″ F.	35″ F.	43″ F.
Off time arriving	*	*	*	*	*	19′ L.	*	*	*
Distance in Miles, one way	2.231	2.637	6.58	4.01	3.51	4 0	3 805	6.266	2.254
Number of Stops	26	35	60	34	30	34	19	41	19
Passengers On	76	93	235	120	216	73	46	239	62
Passengers Off	73	94	241	119	214	74	45	211	62
Cash Fares	49	55	180	100	166	31	46	149	50
Transfers	27	38	55	20	50	42	0	90	12
Tickets	0	0	0	0	0	0	0	0	0
Free Rides	0	0	0	0	0	0	0	0	0
Total Fares	76	93	235	120	216	73	46	239	62
Seating Capacity	28	42	44	44	42	44	39	44	36
Total Time of Stops	4′ 23″	4′ 44″	15′ 21″ (a)	4′ 35″	4′ 1″	4′ 47″	1′ 37″	7′ 13″	2′ 25″
Weather Conditions	Good	Good	Good	Good	Good	Good	Good	Good	Good
RESULTS									
Maximum Load	54	57	125	94	161	68	42	143	48
% Maximum Load to Total Fares	71.0	61.3	53.2	78.3	74.5	93.1	91.3	59.8	77.4
% Maximum Load to Seating Capacity	192.9	135.7	284.2	213.5	383.2	154.3	107.6	325.0	133.2
Average Length of Ride (Miles)	0.951	0.733	2.2	1.785	2.0	2.1	2.1	2.58	1.225
Schedule Speed (Miles per Hour)	6.372	6.588	8.214	8.024	7.624	9.5	7.49	8.01	6.834
Average Speed (Actual)	6.61	6.36	7.38	8.34	7.52	8.62	7.28	9.15	7.14
Average Speed (less Stops)	8.2	8.18	8.81	9.88	8.78	10.0	7.72	10.45	8.45
Average Speed Outside Congested Districts	6.7	6.64	9.37	8.84	7.52	8.86	7.9	11.7	7.82
Stops per Mile (Average)	11.65	13.25	9.1	8.48	8.54	8.5	5.0	6.54	8.44
Distance Between Stops (Average feet)	454	398	581	622	618	621	1056	808	625
Average Length of Stops (Seconds)	10.1	8.1	15.35	8.4	8.03	8.35	5.1	10.6	7.64
% Time of Stops (to Elapsed Time)	21.1	19.8	29.3	15.9	14.26	16.45	5.2	16.71	13.17
% Average Passenger Ride to Car Haul	42.9	27.8	30.7	44.5	57.0	52.5	55.1	41.1	54.3
Origin of Route	Powell-Eddy	3rd & Townsend	Ferry	Ferry	2nd and Howard	8th & Harrison	Geary & Market	5th & Market	Ferry
Actual Load compared with typical rush hour loading — High	Average		Average	Average	50% High	4% High	*	45% High	*
Actual Load compared with typical rush hour loading — Low		20% Low							
Comparison of typical loading, morning with evening rush hours — High					15% Higher		*	*	*
Comparison of typical loading, morning with evening rush hours — Low	25% Lower	40% Lower	13% Lower	30% Lower		12% Lower			
Distance of Maximum Load Point from origin of Route in Miles	0.17	1.01	1.56	1.43	1.91	1.29	0.537	1.7	6.80
Date	Apr. 30, 1912	May 1, 1912	May 2, 1912	May 3, 1912	May 3, 1912	May 6, 1912	May 2, 1912	May 10, 1912	May 7, 1912

ROUTE	Ingleside	Geary (Cable)	California	Jones and Hyde	Union	Eighteenth	Eighteenth	Ninth and Polk	Castro Cable
OBSERVATIONS									
Car Numbers	1722	13	6	54	6	655	651	1521	1
Duration (start) P. M.	5–09′–55″	5–05′–27″	5–10′–00″	5–07′–30″	5–12′–38″	5–04′–58″	5–09′–50″	5–35′–05″	5–24′–05″
Duration (end) P. M.	6–10′–55″	5–38′–52″	5–31′–45″	5–26′–40″	5–45′–43″	5–38′–13″	5–38′–30″	5–55′–05″	5–32′–20″
Off time leaving	1′ 55″ L.	*	*	*	*	2″ F	10″ F	55″ F	1′5 ′ F
Off time arriving	5′ 25″ L.	*	*	*	*	*	30″ L	*	*
Distance in Miles, one way	10.253	3.795	2.8	2.07	3.804	5.008	5.008	2.501	0.893
Number of Stops	66	27	24	21	36	32	30	28	7
Passengers On	196	67	89	87	111	143	122	52	81
Passengers Off	198	61	95	80	112	155	113	48	81
Cash Fares	124	67	78	62	64	68	51	31	1
Transfers	72	0	11	25	47	75	71	21	80
Tickets	0	0	0	0	0	0	0	0	0
Free Rides	0	0	0	0	0	0	0	0	0
Total Fares	196	67	89	87	111	143	122	52	81
Seating Capacity	44	39	34	24	28	30	30	44	36
Total Time of Stops	12′ 6″	4′ 12″	2′ 34″	4′ 1″	5′ 16″	4′ 23″	4′ 26″	2′ 46″	1′ 22″
Weather Conditions	Good	Good	Good	Good	Cloudy	Good	Good	Good	Moderate
RESULTS									
Maximum Load	141	57	66	59	83	89	79	32	81
% Maximum Load to Total Fares	72.0	85.1	74.2	67.8	74.7	62.2	64.7	61.5	100.0
% Maximum Load to Seating Capacity	320.5	146.1	194.1	145.8	296.3	296.4	263.0	72.8	225.0
Average Length of Ride (Miles)	3.38	2.02	0.688	0.82	1.386	1.36	1.42	0.866	0.54
Schedule Speed (Miles per Hour)	10.254	7.49	8.4	7.75	7.36	11.022	11.022	7.648	6.123
Average Speed (Actual)	10.17	6.97	7.7	6.5	6.91	8.7	8.58	7.38	6.7
Average Speed (less Stops)	12.71	7.79	8.76	8.18	8.2	10.4	12.32	8.69	7.8
Average Speed Outside Congested Districts	11.3	7.49	7.7	6.5	8.8	9.82	9.9	7.38	6.7
Stops per Mile (Average)	6.44	7.11	8.58	10.1	9.47	6.38	5.99	11.2	7.83
Distance Between Stops (Average feet)	820	742	615	522	557	827	881	471	675
Average Length of Stops (Seconds)	10.97	9.34	6.41	11.49	8.79	8.22	8.86	5.93	11.7
% Time of Stops (to Elapsed Time)	20.0	12.58	11.81	20.83	15.9	13.18	15.42	13.73	19.4
% Average Passenger Ride to Car Haul	33.0	52.6	24.6	39.6	36.5	27.2	28.4	34.5	60.4
Origin of Route	Ferry	Geary & Market	Calif. & Market	O'Farrell-Grant Ave	Ferry	8th & Harrison	8th & Harrison	9th and Brannan	18th and Castro
Actual Load compared with typical rush hour loading — High	10% High	*	*	*	*	18% High	5.5% High		50% High
Actual Load compared with typical rush hour loading — Low								50% Low	
Comparison of typical loading, morning with evening rush hours — High		*	*	*	*				Average
Comparison of typical loading, morning with evening rush hours — Low	15% Lower					35% Lower	21% Lower	9% Lower	
Distance of Maximum Load Point from origin of Route in Miles	2.64	0.537	0.6	0.98	1.77	2.10	2.10	1.77	0.0
Date	May 7, 1912	Apr. 23, 1912	May 9, 1912	May 9, 1912	May 8, 1912	May 8, 1912	May 10, 1912	Apr. 22. 1912	Apr. 17, 1912

(a) Delay 3′29″ on account of Team Traffic.

(b) 4 minutes dela

Jones and Hyde	Union	Eighteenth	Eighteenth	Ninth and Polk	Castro Cable	Sixth and Sansome	Tenth and Montgomery	Tenth and Montgomery	Howard	San Bruno
54 5-07'-30" 5-26'-40" * *	6 5-12'-38" 5-45'-43" * *	655 5-04'-58" 5-38'-13" 2" F *	651 5-09'-50" 5-38'-30" 10" F 30" L	1521 5-35'-05" 5-55'-05" 55" F *	1 5-24'-05" 5-32'-20" 1'5" F *	616 5-04'-00" 5-32'-00" O.K. *	619 5-20'-40" 5-43'-00" 40" *	619 4-56'-30" 5-18'-50" 30" *	1741 5-00'-05" 5-32'-00" Approx. 10' *	744 4-57'-00" 5-34'-29" 0 *
2.07 21 87 80 62	3.804 36 111 112 64	5.008 32 143 155 68	5.008 30 122 113 51	2.501 28 52 48 31	0.893 7 81 81 1	2.858 32 59 58 55	2.791 30 44 44 36	2.791 25 17 17 8	4.303 40 127 125 72	5.31 49 171 169 69
25 0 0 87 24	47 0 0 111 28	75 0 0 143 30	71 0 0 122 30	21 0 0 52 44	80 0 0 81 36	4 0 0 59 29	6 0 2 44 29	8 0 0 17 29	0 0 0 127 44	63 0 1 171 44
4' 1" Good	5' 16" Cloudy	4' 23" Good	4' 26" Good	2' 46" Good	1' 22" Moderate	7' 39" (b) Good	4' 22" Good	3' 15" Good	8' 24" (c) Good	5' 33" Good
59 67.8 145.8 0.82 7.75 6.5	83 74.7 296.3 1.386 7.36 6.91	89 62.2 296.4 1.36 11.022 8.7	79 64.7 263.0 1.42 11.022 8.58	32 61.5 72.8 0.866 7.648 7.38	81 100.0 225.0 0.54 6.123 6.7	40 67.8 138.0 0.62 7.154 7.55	25 56.8 86.0 1.1 7.28 7.5	8 47.0 27.6 0.7 7.28 7.5	91 71.6 206.7 1.99 8.796 8.07	128 74.8 290.5 2.35 8.382 8.5
8.18 6.5 10.1 522 11.49 20.83	8.2 8.8 9.47 557 8.79 15.9	10.4 9.82 6.38 827 8.22 13.18	12.32 9.9 5.99 881 8.86 15.42	8.69 7.38 11.2 471 5.93 13.73	7.8 6.7 7.83 675 11.7 19.4	8.44 7.86 11.2 471 14.3 27.3	8.65 8.9 10.8 491 8.7 22.0	8.82 8.8 8.96 589 7.8 14.6	10.97 8.73 9.12 580 12.6 24.7	9.98 8.81 9.2 573 6.8 14.7
39.6 O'Farrell-Grant Ave * *	36.5 Ferry * *	27.2 8th & Harrison 18% High 35% Lower	28.4 8th & Harrison 5.5% High 21% Lower	34.5 9th and Brannan 50% Low 9% Lower	60.4 18th and Castro 50% High Average	21.6 10% Low 5% Lower	39.4 * *	25.1 * *	45.3 * *	44.2 * *
0.98 May 9, 1912	1.77 May 8, 1912	2.10 May 8, 1912	2.10 May 10, 1912	1.77 Apr. 22, 1912	0.0 Apr. 17, 1912	0.46 June 19, 1912	0.6 July 9, 1912	0.45 July 9, 1912	2.73 July, 10 1912	1.65 July 11, 1912

(b) 4 minutes delay at Broadway.

(c) 2'20" delay at Stewart account construction work.

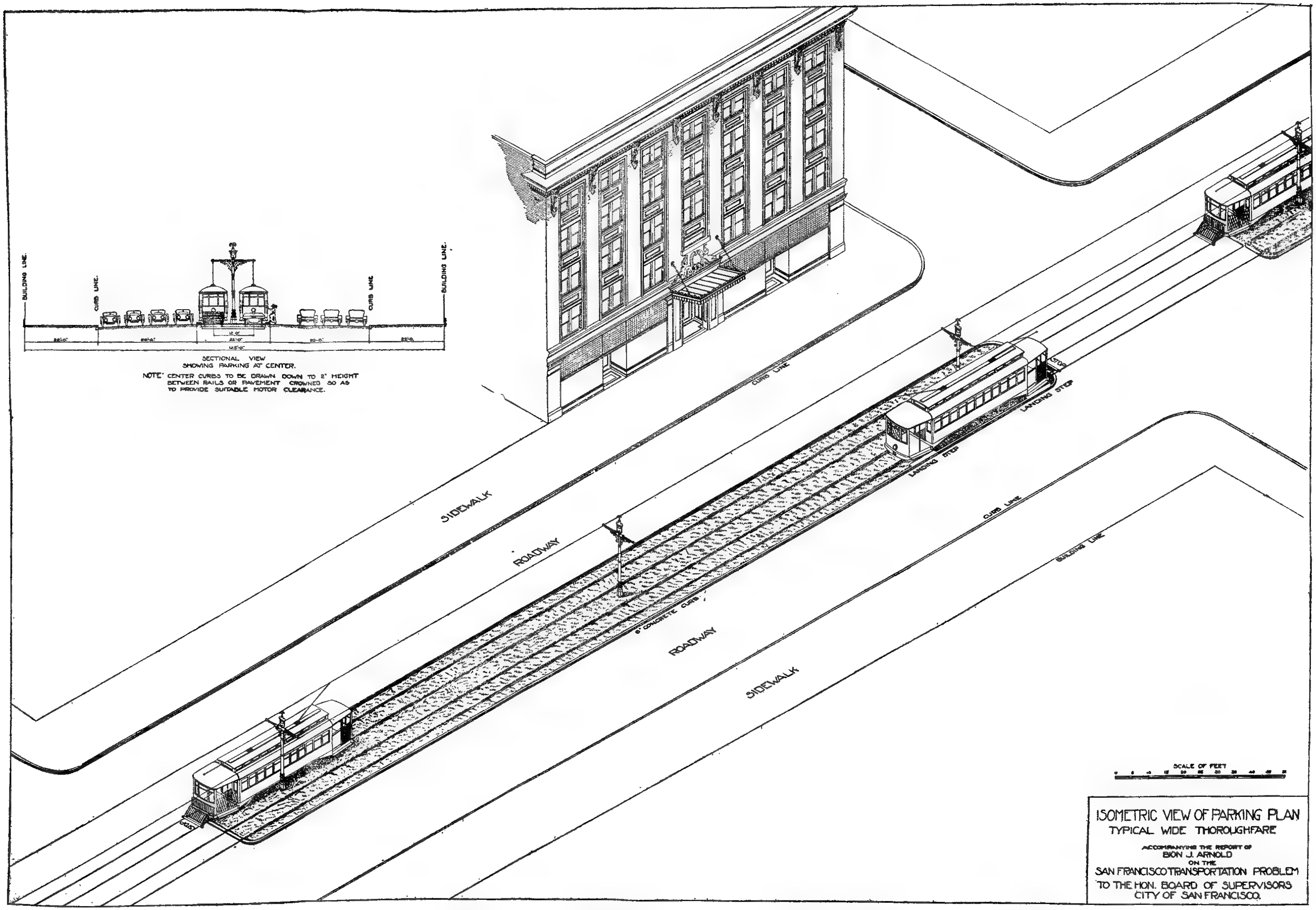


PLATE 18.—RAILWAY PARKING PLAN RECOMMENDED FOR WIDE THOROUGHFARE SUCH AS VAN NESS AVENUE.

Combining the attractive features of a central parking with rapid transportation. Ample roadway width preserved for four lines of automobiles. Ornamental center pole construction with electroliers. During parades one side of the street may be reserved for vehicles and the other for parades without interrupting car service.

TABLE 30.—COMPARATIVE DATA—HARBOR VIEW TUNNELS

TUNNEL	Between	Length Feet	Grade %	South Portal (or West) Approach Grade %	South Portal (or West) Gross Headroom Feet	North Portal (or East) Approach Grade %	North Portal (or East) Gross Headroom Feet	Maximum gradient encountered on traffic route, and location
Divisadero, 82′6″ wide	Sacramento and Filbert	2950	2.37	6.8	36 at Clay	21.8	42 at Union	5.3 on Broderick, California to Sacramento. 6.8 on Divisadero, California to Sacramento. 6.8 on Filbert, Divisadero to Scott.
" " "	Sacramento and Greenwich	3294	3.95	6.8	40 at Clay	10.9	47 at Filbert	5.3 on Broderick, California to Sacramento. 6.8 on Divisadero, California to Sacramento.
" " "	Sacramento and Lombard	3638	4.77	6.8	41 at Clay	4.0	27 at Greenwich	Same as above.
" " "	California and Lombard	3972	3.83	5.5	28 at Sacramento	4.0	27 at Greenwich	3.6 on Broderick, Pine to California.
" " "	Pine and Lombard	4332	3.11	2.2	*24 at California	4.0	27 at Greenwich	2.85 on Divisadero in tunnel.
Pierce, 68′9″ wide	California and Green	2597	2.88	6.9	35 at Sacramento	5.3	27 at Vallejo	6.2 on Pierce, Union to Filbert.
" " "	Pine and Green	2957	1.55	0.7	27 at California	5.3	27 at Vallejo	Same as above.
" " "	California and Union	2941	3.52	6.9	36 at Sacramento	6.2	27 at Green	Same as above and on Steiner, Pine to California.
" " "	Pine and Union	3301	2.44	0.7	*26 at California	6.2	27 at Green	6.2 on Pierce, Union to Filbert.
" " "	California and Vallejo	2253	1.6	6.9	33 at Sacramento	10.3	46 at Broadway	11.1 on Steiner, Green to Union.
Steiner, 68′9″ wide	Pine and Union	3301	3.01	1.8	27 at California	4.2	27 at Green	4.2 on Steiner, Union to Filbert.
" " "	California and Union	2941	4.08	6.2	29 at Sacramento	4.2	27 at Green	4.4 on Fillmore, Bush to Pine.
Fillmore, 68′9″ wide	Sutter and Union	3988	1.65	2.2	27 at Bush	8.4	36 at Green	4.2 on Steiner, Union to Filbert.
" " "	Sutter and Filbert	4332	2.33	2.2	28 at Bush	3.6	27 at Green	2.5 on Steiner, Filbert to Greenwich.
" " "	Bush and Union	3644	2.21	8.0	*23 at Pine	8.4	34 at Green	4.2 on Steiner, Union to Filbert.
" " "	Pine and Union	3301	2.62	6.4	27 at California	8.4	33 at Green	6.4 on Fillmore in tunnel, Pine to California.
" " "	California and Union	2941	3.54	1.45	30 at Sacramento	8.4	30 at Green	4.4 on Fillmore, Bush to Pine.
" " "	Bush and Filbert	3988	3.03	8.0	*23 at Pine	3.6	27 at Union	3.4 on Bush, Steiner to Fillmore.
Broadway, 82′6″ wide	Mason and Larkin	2337½	0.99	3.6	40	5.3	84	6.3 on Broadway, Powell to Stockton.

NOTES—These tunnel grades are based upon a minimum gross headroom of 27 ft. (except as noted thus *), tunnel floor to street, and include dip at entrance. Traffic routes given without regrades.

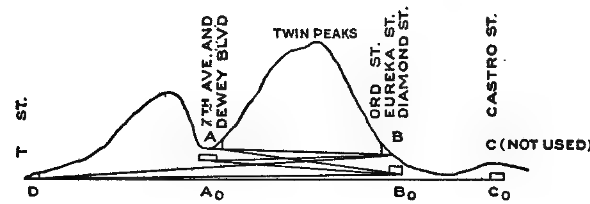


TABLE 31.—COMPARATIVE DATA—TWIN PEAKS TUNNELS

MINIMUM GROSS HEADROOM 20 FEET (STREET GRADE TO SUB-GRADE)

Index Levels	Designation of Tunnel Plans	Market St.	Between	Total Length Feet	Elev. of Out. End	Elev. of In. End	MAIN GRADE Diff. Feet	MAIN GRADE Length Feet	MAIN GRADE Grade %	Main Grade Btweeen
$A–C_0$	High-Level	Not Extended	Dewey Bvd. & Castro	8,500	395	118	277	8,500	3.26	Dewey Bvd. & Castro.
A–B	High-Level, 3A	Ext. Straight	Dewey Bvd. & Eureka	7,300	395	152	243	7,300	3.33	" " " Eureka.
$A–B_0$	" "	" "	" " " Castro	8,500	395	117	278	7,700	3.61	" " " Diamond.
A–B	" "	" Curved	" " " Ord.	6,900	395	182	213	6,900	3.09	" " " Ord.
$A–B_0$	" "	" "	" " " Castro	8,500	395	118	277	8,500	3.26	" " " Castro.
$A_0–C_0$	Low-Level with 7th Ave. Connection, 5	Not Extended	T St. & Castro	11,740	365	118	247	8,500	2.91	" " " Castro.
$A_0–B$	" " " " " "	Ext. Straight	" " " Eureka	10,540	365	152	213	7,300	2.92	" " " Eureka.
$A_0–B_0$	" " " " " " 5A	" "	" " " Castro	11,740	365	117	248	7,700	3.22	" " " Diamond.
$A_0–B$	" " " " " "	" Curved	" " " Ord.	10,140	365	182	183	6,900	2.65	" " " Ord.
$A_0–B_0$	" " " " " " 5B	" "	" " " Castro	11,740	365	118	247	8,500	2.91	" " " Castro.
$D–C_0$	Low-Level without 7th Ave. Connection, 2	Not Extended	" " " Castro	11,700	335	124	211	10,900	1.94	T St. & Diamond.
D–B	" " " " " " 4A	Ext. Straight	" " " Eureka	10,500	335	152	183	10,500	1.74	" " " Eureka.
$D–B_0$	" " " " " " 2	" "	" " " Castro	11,700	335	117	218	10,900	2.0	" " " Diamond.
D–B	" " " " " "	" Curved	" " " Ord.	10,100	335	182	153	10,100	1.52	" " " Ord.
$D–B_0$	" " " " " "	" "	" " " Castro	11,700	335	162	173	10,100	1.71	" " " Ord.
$D–C_0$	" " " " " "	" "	" " " Castro	11,700	335	118	217	11,700	1.86	" " " Castro.

Plan No. 3, A–C, and Plan No. 4, A_0–C, impracticable by reason of dip in Eureka Valley.

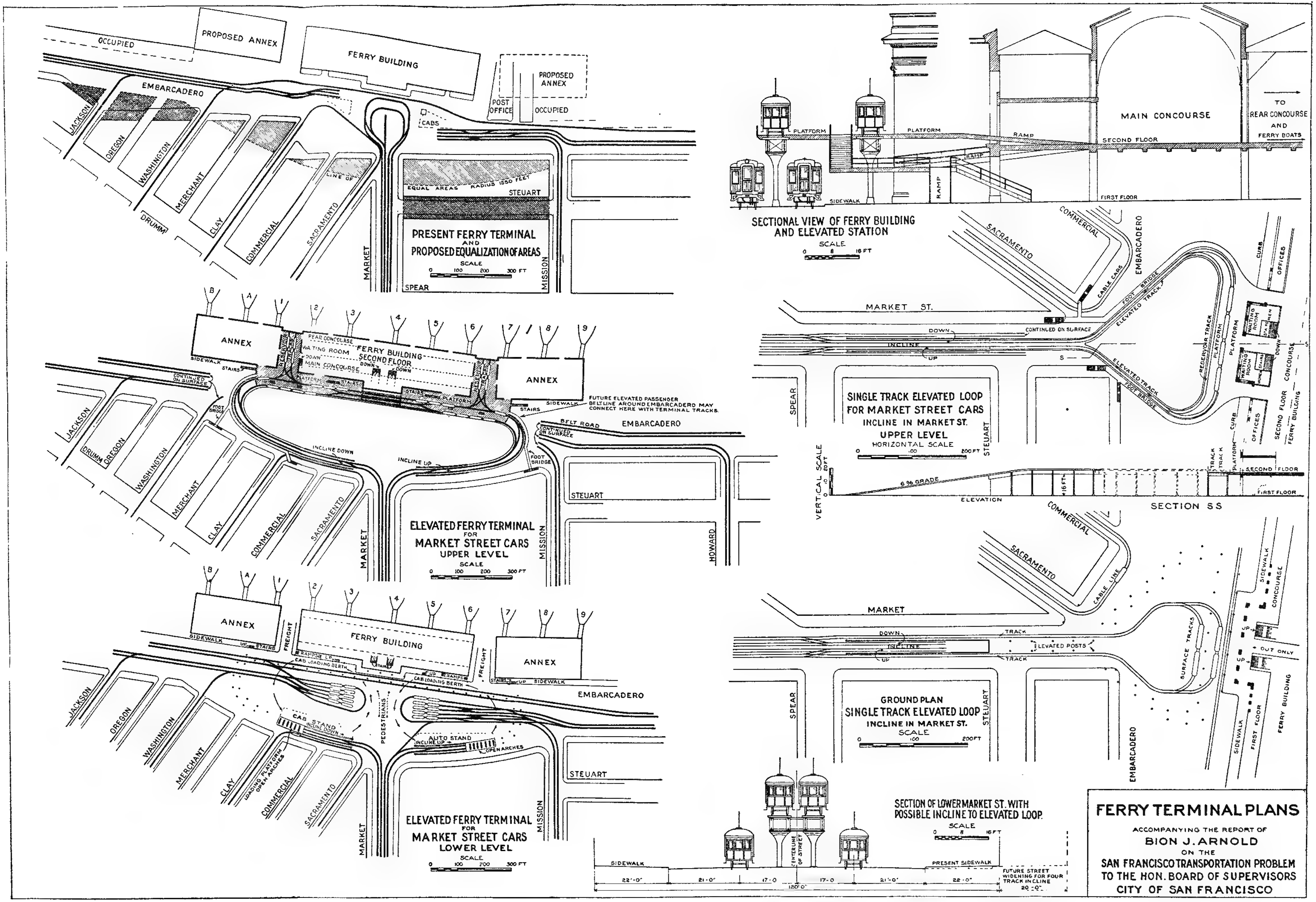


PLATE 19—FERRY TERMINAL IMPROVEMENT PLANS.

With the existing terminals, no reserve capacity is available for either present or future needs. Two plans are therefore presented, both relieving street congestion on The Embarcadero by delivering cars to the upper floor of the Ferry building. One plan designed for more permanent utility involves the evening of property lines on East Street; the other recommends simply the recession of the protruding Sacramento Street corner. Both provide necessary storage track for lay-over cars meeting incoming boats. Loop and storage tracks are now badly needed on both north and south side surface terminals in addition to further capacity of the Market Street loop. With the extension of the Ferry building a corresponding extension of the loading front will be necessary as provided for.

TABLE 33. COMPARATIVE GENERAL BALANCE SHEET—MARCH 20, 1902 AND JUNE 30, 1912.

UNITED RAILROADS OF SAN FRANCISCO.

ASSETS	June 30, 1912	March 20, 1902	Increase	Decrease
RAILROADS, PROPERTIES AND FRANCHISES	$71,141,827.73	$71,748,043.27		$606,215.54
ADDITIONS AND BETTERMENTS TO PROPERTY	11,131,281.96		$11,131,281.96	
MARKET STREET RAILWAY COMPANY				
Five per cent Bonds in Treasury		1,500,000.00		1,500,000.00
MORTGAGE SINKING FUNDS INVESTED	4,109,780.46	653,642.50	3,456,137.96	
FUND FOR IMPROVEMENTS AND BETTERMENTS		1,600,000.00		1,600,000.00
SINKING FUND FOUR PER CENT GOLD BONDS				
Reserved for future betterments, improvements and acquisitions	75,000.00	5,409,000.00		5,334,000.00
EQUITY IN EQUIPMENT UNDER TRUST	247,651.62		247,651.62	
EQUIPMENT UNDER TRUST (Note Holders' Equity—see contra)	300,000.00		300,000.00	
INVESTMENTS IN BONDS AND STOCKS				
Bonds	153,299.17		153,299.17	
Stocks	3,977.40		3,977.40	
FUND FOR ACQUIREMENT OF OUTSTANDING STOCKS	16,954.15	401,856.85		384,902.70
WORKING ASSETS				
Material and Supplies	643,266.24	283,384.96	359,881.28	
Insurance paid in advance	18,224.27	1,266.07	16,958.20	
Interest paid in advance	50.00	50.00		
CURRENT ASSETS				
Cash on Deposit and in Hand	509,728.90	476,254.53	33,474.37	
Bills Receivable	197,148.77	12,750.00	184,398.77	
Accounts Receivable	83,003.75	22,378.97	60,624.78	
Tirey L. Ford, General Counsel		2,064.34		2,064.34
Change and Bail Fund		150.00		150.00
Subscriptions to Common Capital Stock		900.00		900.00
UNADJUSTED ACCOUNTS (Sundry Items in Suspense)	6,693.02		6,693.02	
Total	$88,637,887.44	$82,111,741.49	$15,954,378.53	$9,428,232.58

LIABILITIES	June 30, 1912	March 20, 1902	Increase	Decrease
CAPITAL STOCK, FIRST PREFERRED	$ 5,000,000.00		$5,000,000.00	
CAPITAL STOCK, PREFERRED	20,000,000.00	$20,000,000.00		
CAPITAL STOCK, COMMON	17,948,600.00	20,000,000.00		$2,051,400.00
SINKING FUND 4% GOLD BONDS	25,409,000.00	25,409,000.00		
UNDERLYING BONDS ASSUMED	14,591,000.00	14,591,000.00		
EQUIPMENT TRUST NOTES	300,000.00		300,000.00	
5% PROMISSORY GOLD NOTES	1,000,000.00		1,000,000.00	
INCOME DEFERRED NOTES	1,229,000.00		1,229,000.00	
CONSTITUENT COMPANIES LIABILITY TO OUTSTANDING STOCK OF MARKET STREET, SUTTER AND SUTRO COMPANIES	16,954.15	401,856.85		384,902.70
CURRENT LIABILITIES				
Bills Payable	536,993.94	50,000.00	486,993.94	
Accounts Payable	666,847.48	155,185.65	511,661.83	
Pay Rolls	150,200.94	71,495.27	78,705.67	
Unclaimed Wages	4,106.65	1,209.80	2,896.85	
Interest on Bonds, Due and Unclaimed	27,975.00	40,935.00		12,960.00
Interest on Bonds, July 1st	108,000.00		108,000.00	
Employees' Hospital Fund		2,982.82		2,982.82
ACCRUED NOT DUE				
Interest on Bonds	427,023.31	139,445.57	287,577.74	
Interest on Equipment Notes	750.00		750.00	
Interest on Promissory Gold Notes	20,833.34		20,833.34	
Interest on Income Notes	30,725.00		30,725.00	
Interest on Bills Payable	3,219.96	131.95	3,088.01	
Taxes	166,992.54	52,486.58	114,505.96	
Sinking Fund	152,495.58	48,290.32	104,205.26	
DEPOSITS RECEIVED AND UNREDEEMED TICKETS				
Advertising Contract Deposit	50,000.00		50,000.00	
Employees' Deposits	9,772.75	42,342.00		32,569.25
Unredeemed Tickets	5,834.24	1,213.85	4,620.39	
RESERVES				
For Mortgage Sinking Funds	157,763.88	671,963.62		514,199.74
For Insurance		148,076.88		148,076.88
For Depreciation and Renewals		12,281.94		12,281.94
Profit and Loss Surplus	623,798.68	271,843.39	351,955.29	
Total	$88,637,887.44	$82,111,741.49	$9,685,519.28	$3,159,373.33

Authority—United Railroads Balance Sheets.

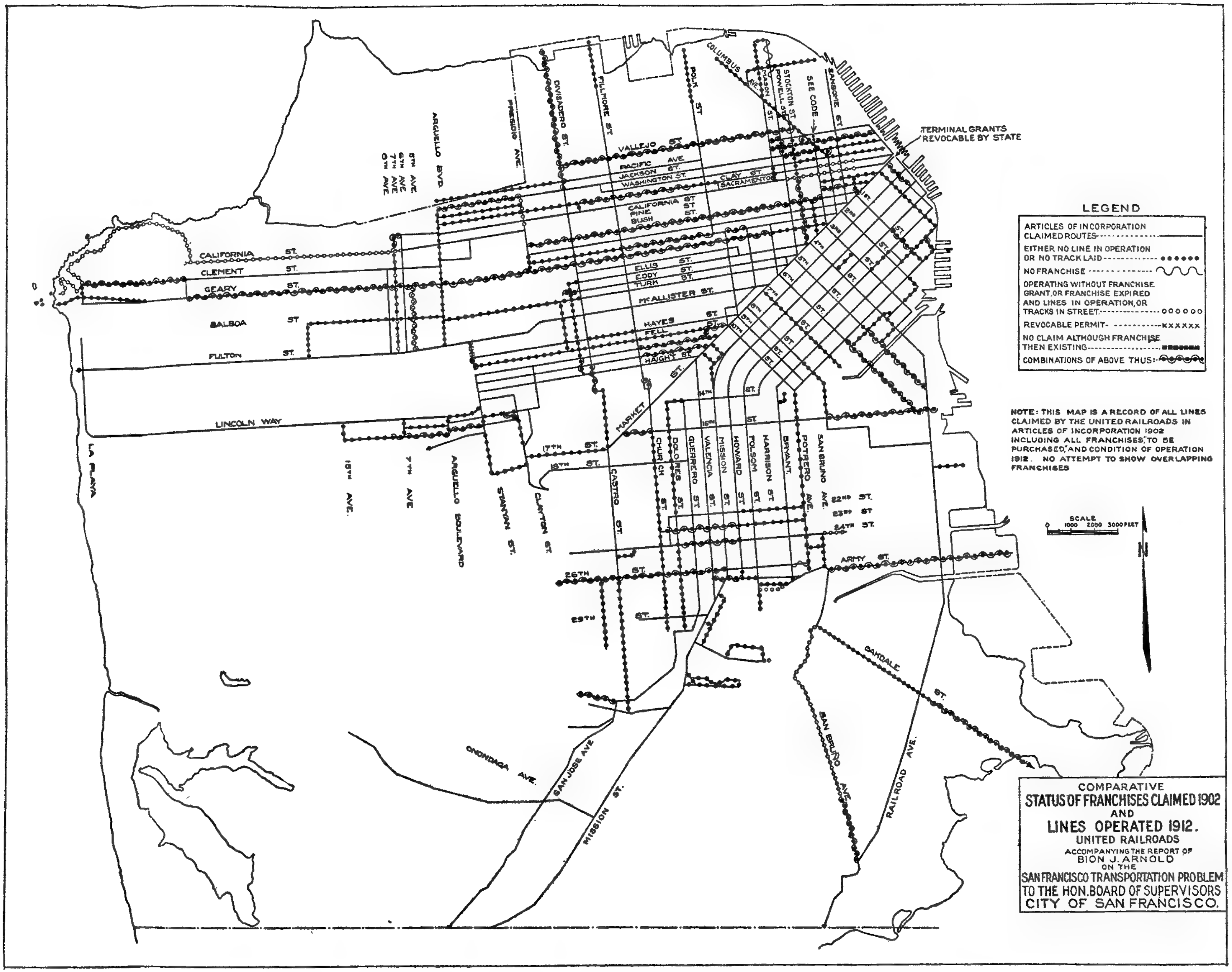


PLATE 20—COMPARATIVE STATUS OF FRANCHISES CLAIMED 1902 AND OPERATED 1912.

All franchises claimed by the articles of incorporation of the United Railroads in 1902 are indicated by the full base lines; while the superimposed coding indicates the operating status in 1912 of these same franchises. Many lines have been abandoned, while in other cases no track has been laid. No attempt has been made to show leased lines or to indicate overlapping franchises. The status of the Columbus Avenue franchises is important, owing to its value as a proposed direct route to the Exposition in 1915. One block on Kearny Street from Pacific Avenue to Broadway was not claimed by the United Railroads in 1902, although a franchise was then existing.

TABLE 41.—ANALYSIS OF INCOME ACCOUNT WITH DISTRIBUTION IN PER CENT OF INCOME—UNITED RAILROADS

Year Ending December 31st,	1900			1901			1902			1903			1904			1905		
		%	%		%	%		%	%		%	%		%	%		%	%
RECEIPTS																		
Total Receipts	$4,713,739.68	100.00	100.00	$5,146,076.60	100.00	100.00	$5,564,923.77	100.00	100.00	$6,267,972.97	100.00	100.00	$6,683,300.59	100.00	100.00	$7,102,528.06	100.00	100.00
Gross Earnings from Operation	4,687,069.86	99.43		5,118,663.18	99.47		5,538,918.61	99.53		6,243,218.97	99.60		6,652,630.27	99.54		7,066,891.94	99.50	
Passenger Receipts	4,657,635.82	98.80		5,089,776.23	98.95		5,489,622.15	98.70		6,189,898.01	98.75		6,591,842.85	98.60		7,000,343.39	98.60	
Other Income	26,669.82	0.57		27,413.42	0.53		26,005.16	0.47		24,754.00	0.40		30,670.32	0.46		35,636.12	0.50	
OPERATING EXPENSES																		
Total Maintenance	485,572.78	100.00	10.30	560,416.05	100.00	10.89	647,966.89	100.00	11.65	693,768.24	100.00	11.06	827,060.97	100.00	12.38	813,799.70	100.00	11.45
Total of Way and Structures	125,996.92	25.96	2.67	142,652.03	25.47	2.77	356,756.69	55.00	6.42	354,153.45	51.00	5.64	382,611.94	46.25	5.73	473,058.99	58.13	6.66
Track and Roadway only	109,035.79	22.46		123,808.58	22.10		187,292.96	28.90		158,286.93	22.66		171,738.34	20.76		243,897.72	29.95	
Total Equipment	359,575.86	74.04	7.63	417,764.02	74.53	8.12	291,210.20	45.00	5.23	339,614.79	49.00	5.42	444,449.03	53.75	6.65	340,740.71	41.87	4.80
Revenue Equipment only							149,820.24	23.12		283,076.30	40.80		360,325.11	43.58		282,154.49	34.68	
Transportation Expenses	1,701,200.84	100.00	36.10	1,826,481.36	100.00	35.49	1,857,493.00	100.00	33.38	2,089,700.56	100.00	33.33	2,092,722.81	100.00	31.30	2,029,676.75	100.00	28.57
Operation of Power Plants	402,220.87	23.66	8.53	424,989.05	23.28	8.26	413,590.88	22.27	7.43	430,271.75	20.60	6.86	396,188.73	18.93	5.93	361,460.95	17.82	5.09
Operation of Cars	1,298,979.97	76.34		1,401,492.31	76.72		1,443,902.12	77.73		1,659,428.81	79.40		1,696,534.08	81.07		1,668,215.80	82.18	
Platform Expenses (wages)	1,076,062.24	63.25	22.83	1,172,706.62	64.20	22.80	1,245,347.17	67.05	22.38	1,411,916.94	67.50	22.52	1,418,886.49	67.75	21.24	1,380,810.51	68.00	19.45
General and Miscellaneous Expenses	236,244.25	100.00	5.01	304,650.72	100.00	5.92	365,331.37	100.00	6.56	470,847.79	100.00	7.51	379,954.63	100.00	5.68	385,464.61	100.00	5.43
Injuries and Damages	39,252.90	16.62	0.83	82,899.71	27.22	1.61	136,448.83	37.32	2.45	150,028.95	31.86	2.39	132,710.28	34.90	1.99	132,713.55	34.42	1.87
Legal Expenses	16,961.12	7.18		43,603.05	14.32		20,740.40	5.68		29,620.10	6.29		42,672.74	11.23		62,398.98	16.18	
Total Operating Expenses	2,423,017.87		51.41	2,691,548.13		52.30	2,870,791.26		51.59	3,254,316.59		51.90	3,299,738.41		49.36	3,228,941.06		45.45
Taxes	346,790.96		7.35	362,904.70		7.05	403,337.45		7.24	409,200.00		6.53	376,700.00		5.64	388,879.91		5.48
Operating Expenses and Taxes	2,769,808.83		58.76	3,054,452.83		59.35	3,274,128.71		58.83	3,663,516.59		58.43	3,676,438.41		55.00	3,617,820.97		50.93
Renewals and Depreciation										144,818.47		2.32	410,692.16(a)		6.14	353,344.60		4.98
Total Operating Accounts	2,769,808.83		58.76	3,054,452.83		59.35	3,274,128.71		58.83	3,808,335.06		60.75	4,087,130.57		61.14	3,971,165.57		55.91
Gross Corporate Income	1,943,930.85		41.24	2,091,623.77		40.65	2,290,795.06		41.17	2,459,637.91		39.25	2,596,170.02		38.86	3,131,362.49		44.09
DEDUCTIONS FROM INCOME																		
Miscellaneous Deductions, Interest on Floating Debt and Rentals and Leases	10,362.39		0.22	8,797.16		0.17	2,114.32		0.04	12,388.09		0.20	71,710.20(b)		1.07	7,838.89		0.11
Interest on Bonded Debt, Notes, etc.	723,200.00		15.34	723,200.00		14.05	1,324,049.88		23.79	1,524,050.10		24.32	1,524,050.00		22.82	1,524,050.00		21.46
Net Corporate Income	1,210,368.46		25.68	1,359,626.61		26.43	964,630.86		17.33	923,199.72		14.73	1,000,409.82		14.97	1,599,473.60		22.52
Sinking Funds	84,000.00		1.78	84,000.00		1.63	95,710.01		1.72	123,999.67		1.98	257,052.59		3.85	265,337.84		3.74
Surplus or Deficit (Dividends **not** deducted)	1,126,368.46		23.90	1,275,626.61		24.80	868,920.85		15.61	799,200.05		12.75	743,357.23		11.12	1,334,135.76		18.78

Year Ending December 31st,	1906			1907			1908			1909			1910			1911		
		%	%		%	%		%	%		%	%		%	%		%	%
RECEIPTS																		
Total Receipts	$5,982,597.66	100.00	100.00	$4,765,119.51	100.00	100.00	$6,908,061.61	100.00	100.00	$7,522,867.90	100.00	100.00	$7,740,659.91	100.00	100.00	$7,966,987.32	100.00	100.00
Gross Earnings from Operation	5,955,786.32	99.55		4,745,116.44	99.58		6,866,302.73	99.40		7,455,965.30	99.11		7,653,489.15	98.87		7,886,136.08	98.98	
Passenger Receipts	5,905,303.24	98.71		4,706,019.44	98.76		6,807,948.37	98.55		7,405,691.66	98.44		7,605,489.15	98.25		7,836,136.08	98.36	
Other Income	26,811.34	0.45		20,003.07	0.42		41,758.88	0.60		66,902.60	0.89		87,170.76	1.13		80,851.24	1.02	
OPERATING EXPENSES																		
Total Maintenance	655,035.18	100.00	10.95	1,068,817.66	100.00	22.43	1,017,042.30	100.00	14.73	1,041,902.93	100.00	13.85	978,144.20	100.00	12.63	904,608.77	100.00	11.36
Total of Way and Structures	333,182.51	50.85	5.57	271,515.10	25.40	5.70	304,548.30	29.95	4.41	324,948.69	31.18	4.32	344,758.28	35.25	4.45	368,612.75	40.75	4.63
Track and Roadway only	233,349.12	35.65		175,669.42	16.44		197,512.54	19.43		203,265.82	19.52		282,656.18	28.90		294,243.81	32.52	3.70
Total Equipment	321,852.67	49.15	5.38	797,302.56	74.60	16.73	712,494.00	70.05	10.32	716,954.24	68.82	9.53	633,385.92	64.75	8.18	535,996.02	59.25	6.73
Revenue Equipment only	266,267.62	40.65		680,142.63	63.60		611,484.55	60.15		635,262.50	61.00		545,812.87	55.80		452,396.47	50.00	
Transportation Expenses	1,704,443.77	100.00	28.48	1,872,601.49(c)	100.00	39.30	2,703,140.90	100.00	39.12	2,686,797.01	100.00	35.71	2,770,211.88	100.00	35.79	2,798,315.68	100.00	35.12
Operation of Power Plants	369,750.04	21.70	6.18	481,141.07		10.10	1,076,872.42	39.85	15.59	1,048,361.92	39.00	13.93	1,051,509.90	37.95	13.59	1,034,352.74	36.96	12.98
Operation of Cars	1,334,693.73	78.30		1,392,152.92			1,626,268.48	60.15		1,638,435.09	61.00		1,718,701.98	62.05		1,763,962.94	63.00	
Platform Expenses (wages)	1,069,877.78	63.35	17.88	1,010,857.13	54.00	21.21	1,288,078.64	47.65	18.65	1,324,299.59	49.30	17.60	1,358,984.95	49.05	17.56	1,407,603.01	50.30	17.67
General and Miscellaneous Expenses	359,748.28	100.00	6.01	498,180.31	100.00	10.45	522,567.02	100.00	7.57	513,948.78	100.00	6.83	532,814.48	100.00	6.88	600,026.53	100.00	7.54
Injuries and Damages	139,220.76	38.68	2.33	206,819.62	41.50	4.34	229,702.51	43.95	3.33	224,764.73	43.75	2.99	238,323.22	44.72	3.08	267,075.94	44.50	3.35
Legal Expenses	25,621.91	7.12		25,154.36	5.05		33,912.37	6.49		53,943.08	9.53		49,122.57	9.22		76,075.66	12.68	
Total Operating Expenses	2,719,227.23		45.44	3,439,599.46		72.18	4,242,750.22		61.42	4,242,648.72		56.39	4,281,170.56		55.30	4,302,970.98		54.02
Taxes	395,362.86		6.61	407,800.00		8.56	347,920.00		5.04	396,200.00		5.27	448,100.00		5.79	404,000.00		5.07
Operating Expenses and Taxes	3,114,590.09		52.05	3,847,399.46		80.74	4,590,670.22		66.46	4,638,848.72		61.66	4,729,270.56		61.09	4,706,970.98		59.09
Renewals and Depreciation	129,812.59		2.17							157,391.10		2.09	458,959.35(d)		5.93	473,168.16(d)		5.94
Total Operating Accounts	3,244,402.68		54.22	3,847,399.46		80.74	4,590,670.22		66.46	4,796,239.82		63.75	5,188,229.91		67.02	5,180,139.14		65.03
Gross Corporate Income	2,738,194.98		45.78	917,720.05		19.26	2,317,391.39		33.54	2,726,628.08		36.25	2,552,430.00		32.98	2,786,848.18		34.97
DEDUCTIONS FROM INCOME																		
Miscellaneous Deductions, Interest on Floating Debt and Rentals and Leases	37,231.13		0.62	179,097.60		3.76	220,718.20		3.19	115,627.99		1.54	180,000.22		2.33	136,687.76		1.71
Interest on Bonded Debt, Notes, etc.	1,580,702.14		26.43	1,753,111.18		36.78	1,772,336.62		25.65	1,843,408.68		24.50	1,862,410.00		24.06	1,958,525.00		24.58
Net Corporate Income	1,120,261.71		18.73	—1,014,488.73		—21.28	324,336.57		4.70	767,591.41		10.21	510,019.78		6.59	691,635.42		8.68
Sinking Funds	243,115.73		4.07	287,333.34		6.03	351,326.05		5.08	363,119.31		4.83	367,069.78		4.74	371,722.72		4.67
Surplus or Deficit (Dividends **not** deducted)	877,145.98		14.66	—1,301,822.07		—27.31	—26,989.48		—0.38	404,472.10		5.38	142,950.00		1.85	319,912.70		4.01

Authority—Yearly records of Income Accounts of the United Railroads of San Francisco.

(a) (1904)—Includes amount set aside to cover loss in sales of abandoned power house machinery, $161,353.42.

(b) (1904)—Includes expense of threatened strike, $62,345.65.

(c) (1907)—Total Transportation Expenses given as $1,872,601.49, but sum of items "Operation of Cars" and "Operation of Power Plants" is in excess of this amount by $692.50.

(d) (1910–1911)—Charged directly to Profit and Loss in Capital Account, not against Income Account.

NOTE—United Railroads began operation March 20, 1902. Data for previous years comprise railways which subsequently became United Railroads.

This income account and distribution as shown is analyzed on a strictly operative basis by eliminating "interest on bond and sinking fund investments" from other income.

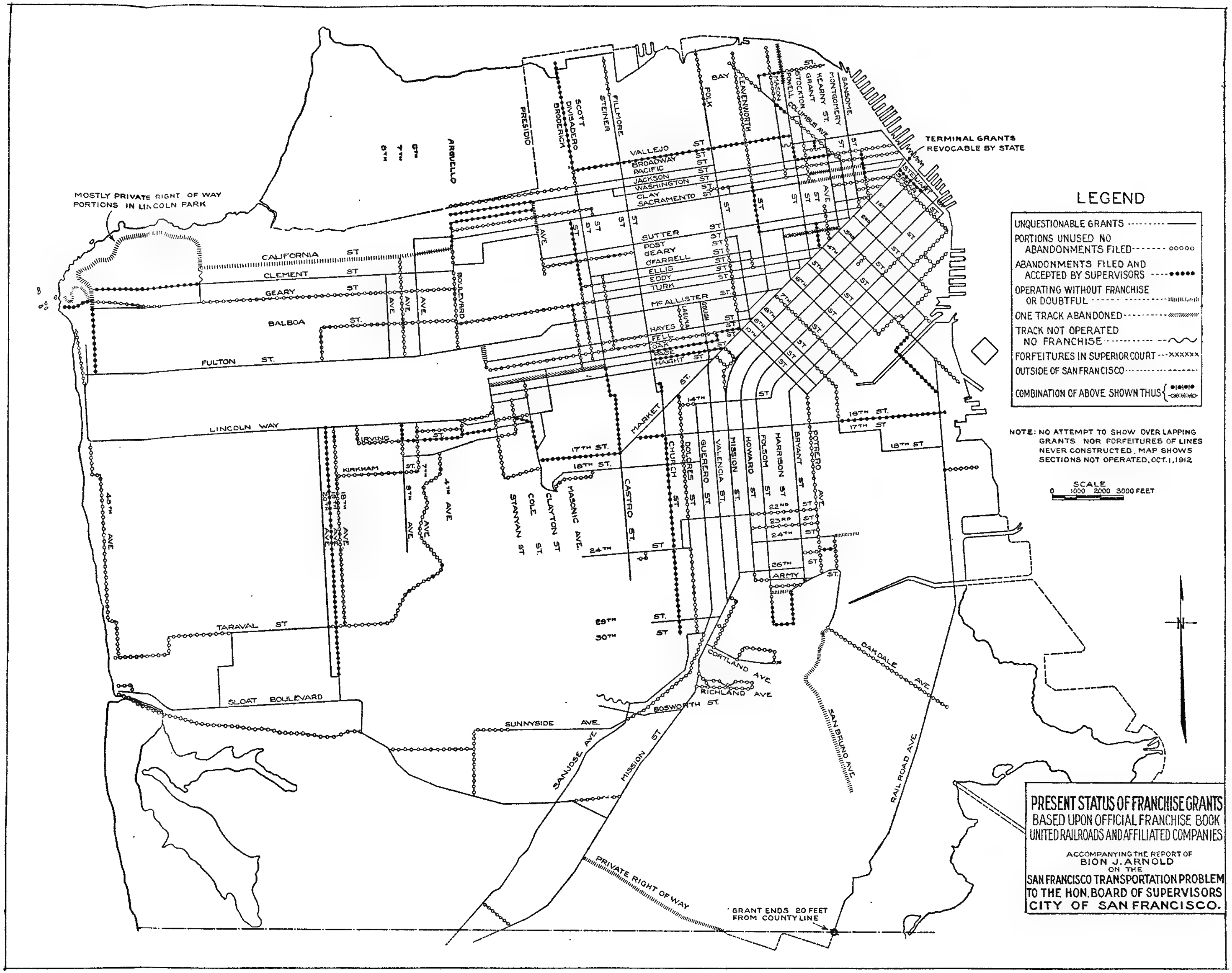


PLATE 21—PRESENT STATUS OF FRANCHISE GRANTS.

On this map are shown by graphical code (a) all franchises granted to the United Railroads, underlying companies, and leased lines, also (b) routes operated without franchises or where franchises are doubtful in accordance with the existing record of the municipal franchise book. Over-lapping franchises have not been considered. The status of abandoned trackage is important, especially where portions of franchises have been abandoned without official notice being filed with and accepted by the Supervisors. This raises the question of validity of the remaining portions of such routes. Also of such routes now operated as have not been constructed within the time limit set by law.

TABLE 42.—DISTRIBUTION OF OPERATING EXPENSES BY YEARS

UNITED RAILROADS

Year Ending December 31st	1903	1904	1905	1906	1907	1908	1909	1910	1911
MAINTENANCE WAY AND STRUCTURES									
TOTAL MAINTENANCE TRACK AND ROADWAY	$ 158,286.93	$171,738.34	$243,897.72	$233,349.12	$175,669.42	$197,512.54	$203,265.82	$282,656.18	$294,243.81
Superintendence								11,988.18	12,158.68
Special Work								3,670.80	11,404.10
Roadway and Track Labor								103,802.87	107,606.39
Paving						54,571.64	50,179.09	66,826.11	75,832.25
Cleaning and Sanding Track								36,657.03	38,018.79
Rails and Ties	6,800.73	3,147.13	9,839.14	8,710.33	4,031.18	6,188.95	5,340.56	7,004.48	10,175.21
TOTAL MAINTENANCE OF LINE	174,629.87	181,142.91	202,819.93	84,458.20	79,911.81	90,232.41	103,503.74	39,720.54	56,192.15
Superintendence								2,852.34	3,725.55
Poles and Fixtures	28,845.61*	24, 939.86*	30,846.07*	31,051.00*	39,087.06*	38,496.59*	44,952.89*	3,494.56	8,827.69
Overhead Trolley								24,630.86	31,882.84
Cables	109,389.34	121,227.55	132,579.17	37,059.01	23,407.08	34,611.95	41,514.75	**	**
TOTAL MAINTENANCE STRUCTURES AND FIXTURES	21,236.65	29,730.69	26,341.34	15,375.19	15,933.47	16,803.35	18,179.13	22,381.56	18,176.79
Superintendence								853.43	1,200.00
Car Houses	12,838.53	19,057.30	21,080.03	8,769.25	11,845.94	8,490.78	9,617.42	8,120.44	8,412.08
Shops								4,826.67	3,586.84
TOTAL MAINTENANCE WAY AND STRUCTURES	354,153.45	382,611.94	473,058.99	333,182.51	271,515.10	304,548.30	324,948.69	344,758.28	368,612.75
MAINTENANCE OF EQUIPMENT									
TOTAL MAINTENANCE OF MOTIVE POWER EQUIPMENT	39,709.85	63,452,89	38,804.55	31,896.65	69,139.92	64,623.23	30,619.62	42,879.31	39,232.66
Superintendence								1,247.55	1,140.40
Cables, Repairs, Wages of Ropemen								37,582.99	35,336.66
Power Plant Equipment	39,709.85	63,452.89	38,804.55	31,896.65	69,139.92	64,623.23	30,619.62	1,430.96	1,172.36
TOTAL MAINTENANCE OF REVENUE EQUIPMENT	283,076.30	360,325.11	282,154.49	266,267.62	680,142.63	611,484.55	635,262.50	545,812.87	452,396.47
Superintendence								11,928.61	22,264.76
Bodies and Fenders	56,780.73	82,469.85	48,186.47	50,338.31	139,069.75	97,181.34	89,365.59	91,508.72	81,077.45
Trucks	111,314.12	131,010.14	104,341.40	87,487.97	218,971.52	239,272.74	245,558.71	184,674.52	150,565.31
Painting	13,472.73	40,451.30	27,400.64	8,126.83	4,849.98	5,607.01	13,950.47	35,122.38	35,871.20
Electrical Equipment	63,818.96	72,165.15	70,043.51	110,660.51	310,821.50	259,256.28	275,271.16	212,930.68	153,928.48
Cable Equipment	29,622.83	27,513.41	23,500.39	7,479.42	4,857.28	8,008.51	9,882.30	9,647.96	8,689.27
MISCELLANEOUS EQUIPMENT EXPENSES									
Service Cars	656.28	1,851.48	2,749.74	5,851.01	10,316.06	7,686.07	13,949.65	8,483.87	9,470.02
Shop Expenses	15,391.60	17,998.95	16,664.96	17,679.11	36,342.40	28,354.54	36,878.89	25,622.15	22,062.24
Shop Machinery and Tools								3,575.96	8,561.86
Horses and Vehicles								6,944.51	4,253.12
TOTAL MAINTENANCE OF EQUIPMENT	339,614.79	444,449.03	340,740.71	321,852.67	797,302.56	712,494.00	716,954.24	633,385.92	535,996.02
CONDUCTING TRANSPORTATION									
TOTAL OPERATION OF POWER PLANTS	$430,271.75	$396,188.73	$361,460.95	$369,750.04	$481,141.07	$1,076,872.42	$1,048,361.92	$1,051,509.90	$1,034,352.74
Superintendence								1,412.95	2,174.63
Power Plant Employees	103,896.46(a)	111,919.49(a)	106,161.41(a)	77,643.30(a)	85,054.33(a)	85,059.68(a)	63,663.87(a)	7,713.75	10,575.25
Sub-Station Employees								21,613.65	21,330.85
Power Purchased	59,857.60	1,975.69	....	127,930.87	220,081.17	711,101.04	849,969.31	993,162.56	990,539.62
Fuel for Power	243,825.04	248,402.09	225,330.94	144,994.40	156,268.14	255,211.88	118,256.86	20,082.78	6,397.46
TOTAL OPERATION OF CARS	1,659,428.81	1,696,534.08	1,668,215.80	1,334,693.73	1,392,152.92	1,626,268.48	1,638,435.09	1,718,701.98	1,763,982.94
Superintendence	111,362.52(b)	123,240.86(b)	121,206.01(b)	99,617.26(b)	140,317.57(b)	128,392.14(b)	117,336.54(b)	109,708.29	113,914.71
Wages of Conductors, Motormen, Gripmen	1,411,916.94	1,418,886.49	1,380,810.51	1,069,877.78	1,010,857.13	1,288,078.64	1,324,299.59	1,358,984.95	1,407,603.01
Miscellaneous Car Service Employees								16,887.50	12,630.52
Car House Employees								143,323.52	157,982.41
Car House Expenses	61,082.96	67,501.00	78,641.22	54,035.10	77,170.59	86,730.68	91,072.85	8,368.39	3,196.49
TOTAL CONDUCTING TRANSPORTATION	2,089,700.56	2,092,722.81	2,029,676.75	1,704,443.77	1,872,601.49	2,703,140.90	2,686,797.01	2,770,211.88	2,798,335.68
GENERAL AND MISCELLANEOUS EXPENSES									
Salaries and Expenses of General Officers	98,926.36(c)	102,118.89(c)	97,246.58(c)	96,359.87(c)	135,868.62(c)	127,534.72(c)	123,069.32(c)	64,948.38	73,284.75
Salaries and Expenses of General Office Clerks								47,520.10	47,983.94
Law Expense	29,602.10	42,672.74	62,398.98	25,621.91	25,154.36	33,912.37	53,943.08	49,122.57	76,075.66
Injuries and Damages	150,028.95	132,710.28	132,713.55	139,220.76	206,819.62	229,702.51	224,764.73	238,323.22	267,075.94
Insurance	38,070.90	21,156.12	20,407.95	25,718.00	25,279.14	23,400.00	27,813.61	22,004.16	21,750.00
Rents of Tracks and Terminals								3,000.00	5,250.00
TOTAL GENERAL AND MISCELLANEOUS EXPENSES	470,847.79	379,954.63	385,464.61	359,748.28	498,180.31	522,567.02	513,948.78	532,814.48	600,026.53
RENEWALS	96,545.66	133,052.59	141,337.84						
TOTAL EXPENSES FOR PERIOD	3,350,862.25(d)	3,432,791.00(d)	3,370,278.90(d)	2,719,227.23	3,439,599.46	4,242,750.22	4,242,648.72	4,281,170.56	4,302,970.98

*Includes poles, wires and circuits.
**This item is transferred to "Motive Power Equipment." Accounts redistributed.
(a) Includes all wages under "Operation of Power Plants."
(b) Includes superintendence, dispatch and road service.
(c) Includes salaries and expenses of general office clerks.
(d) Totals differ from Income Account by amount of Renewals.
Authority—Monthly Balance Sheets, United Railroads.

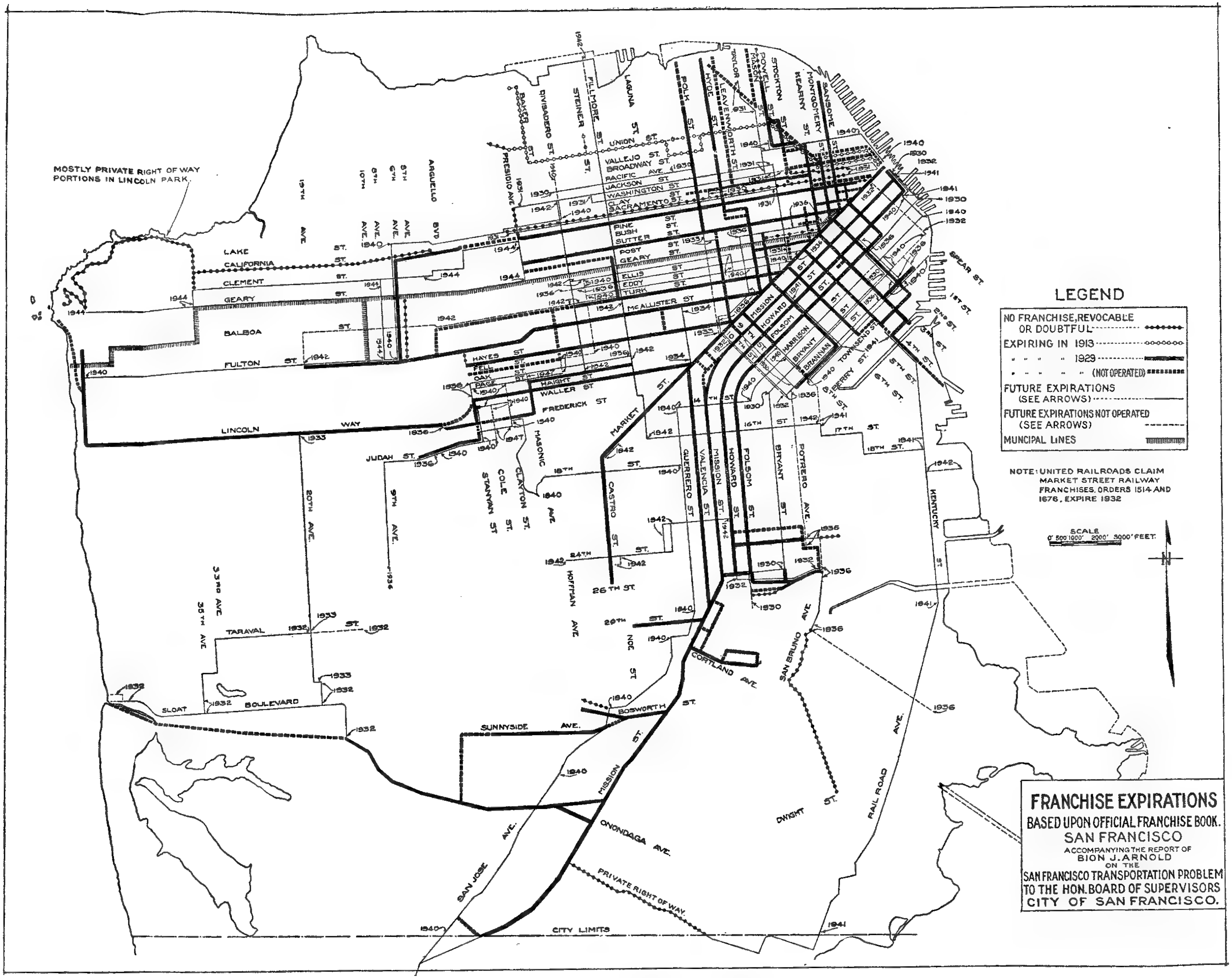


PLATE 22—RECORD OF FRANCHISE EXPIRATIONS.

This plate interprets graphically the record of the official franchise book in the matter of expirations, showing the amount of track involved. Obviously the major portion of the franchises expire in 1929 representing about two-thirds of the earning capacity, and some important parts such as outer California Street are now operating without franchise. The Presidio & Ferries system reverts to the City during the present year. With the expiration of the Market Street lines, the operating system will be practically disrupted. Some question exists, however, as to the exact date of expiration—whether 1929 or 1932. (See Figure 101.)

TABLE 50a.—COMPARATIVE RECORDS REVENUE CAR MILES, TOTAL PASSENGERS, AND REVENUE PASSENGERS, BY MONTHS,

UNITED RAILROADS

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
REVENUE CAR MILES											
January	1,510,704	1,608,442	1,660,865	1,627,109	1,710,455	1,388,371	1,522,295	1,668,135	1,813,783	1,813,218	1,912,394
February	1,358,009	1,438,039	1,549,333	1,480,354	1,558,211	1,226,104	1,499,096	1,512,843	1,632,150	1,613,817	1,802,392
March	1,539,709	1,633,174	1,654,558	1,651,479	1,747,517	1,254,510	1,610,483	1,653,052	1,813,562	1,800,249	
April	1,136,439	1,599,417	1,632,138	1,613,604	969,819	1,363,922	1,645,201	1,630,260	1,783,920	1,806,565	
May	1,560,785	1,661,232	1,680,036	1,664,823	800,634	394,936	1,794,081	1,732,207	1,844,525	1,905,065	
June	1,532,957	1,601,941	1,629,492	1,633,818	1,119,207	511,610	1,680,374	1,691,571	1,747,133	1,851,534	
TOTAL 1ST 6 MOS	8,638,603	9,587,245	9,806,422	9,671,187	7,905,843	6,139,453	9,751,530	9,888,068	10,635,073	10,790,448	
July	1,584,490	1,653,115	1,660,846	1,677,315	1,307,246	786,976	1,747,741	1,767,550	1,794,750	1,904,343	
August	1,591,981	1,680,561	1,644,664	1,667,854	1,056,662	1,078,596	1,692,910	1,778,810	1,757,824	1,893,136	
September	1,528,788	1,631,742	1,622,392	1,621,587	1,052,270	955,246	1,593,927	1,722,148	1,728,401	1,835,293	
October	1,578,752	1,686,529	1,635,921	1,668,317	1,297,215	1,119,423	1,614,799	1,852,431	1,769,348	1,903,818	
November	1,532,440	1,622,528	1,597,477	1,601,186	1,279,788	1,238,025	1,516,795	1,724,234	1,719,424	1,836,932	
December	1,604,364	1,686,705	1,636,816	1,710,414	1,361,126	1,352,769	1,613,214	1,784,170	1,805,486	1,913,459	
TOTAL 2ND 6 MOS	9,420,815	9,961,180	9,798,116	9,946,673	7,354,307	6,531,035	9,779,386	10,629,343	10,575,233	11,286,981	
TOTAL PASSENGERS											
January				16,252,845	17,804,962	16,977,497	14,930,388	16,171,671	17,775,800	18,170,901	19,328,125
February				15,551,201	16,745,807	16,152,372	14,104,207	15,649,460	16,269,000	16,578,031	18,732,540
March			15,906,441	17,470,413	18,582,577	17,229,790	16,196,631	17,481,277	18,513,315	18,916,395	
April			17,074,421	17,686,526	11,036,936	18,684,838	16,208,077	17,729,349	18,525,143	18,615,226	
May			17,207,819	17,997,619	10,362,836	3,754,055	18,578,247	18,136,556	18,845,147	19,206,272	
June			15,609,391	16,868,958	14,396,103	4,834,262	15,981,586	17,003,561	17,335,793	17,937,666	
TOTAL 1ST 6 MOS			95,812,547	101,827,562	88,929,221	77,632,814	95,999,176	102,171,874	107,290,198	109,424,491	
July			15,884,767	17,202,419	16,244,481	7,839,760	16,320,406	17,600,365	17,695,657	18,382,545	
August			16,511,106	18,278,537	13,697,091	10,388,945	16,891,674	18,318,401	18,456,872	19,356,607	
September			18,243,222	18,419,539	13,409,654	11,892,506	16,762,784	17,902,670	18,642,837	19,294,509	
October			17,887,637	19,276,037	17,507,962	14,183,103	16,944,214	20,519,687	19,299,414	20,166,209	
November			17,004,265	18,049,744	17,249,236	14,873,313	16,208,933	17,707,194	18,230,935	19,462,579	
December			16,854,297	18,490,196	17,612,012	15,620,704	17,004,010	18,181,095	19,279,148	19,874,020	
TOTAL 2ND 6 MOS			102,385,294	109,716,772	95,720,436	74,798,331	100,132,021	110,229,412	111,604,863	116,536,469	
REVENUE PASSENGERS (Including Fare and Passes)											
January	8,372,106(*a*)	9,460,386(*a*)	10,601,445	10,945,821	12,073,056	10,895,953	10,087,761	11,389,600	12,631,246	12,854,399	13,517,783
February	7,845,287	8,902,145	9,739,910	10,417,827	11,347,774	10,328,264	9,997,937	10,942,520	11,489,946	11,626,215	13,054,407
March	9,425,524	9,939,428	10,755,312	11,688,408	12,582,577	11,069,570	11,398,088	12,217,127	13,046,106	13,252,026	
April	6,864,918	10,340,796	11,454,631	11,850,073	7,497,573	11,952,427	11,414,762	12,448,637	12,036,432	13,094,468	
May	9,407,067	10,842,748	11,546,320	12,046,444	6,571,356	2,597,496	13,272,484	12,736,536	13,166,577	13,434,797	
June	9,016,358	9,693,736	10,491,702	11,269,565	9,007,628	3,073,331	11,057,737	11,960,345	12,127,106	12,544,192	
TOTAL 1ST 6 MOS	50,931,260	59,179,239	64,589,320	68,218,138	59,079,964	49,912,041	67,228,809	71,694,765	75,496,413	76,806,097	
July	9,072,606	9,941,778	10,697,483	11,516,522	10,213,304	4,770,680	11,285,421	12,380,814	12,372,291	12,883,121	
August	10,567,257	11,436,051	11,109,705	12,222,996	8,632,661	6,415,639	11,734,704	12,888,861	12,885,467	13,562,093	
September	9,732,006	10,813,184	12,401,294	12,338,048	8,503,368	7,442,593	11,690,876	12,625,483	13,167,291	13,511,217	
October	10,107,382	11,355,713	11,960,464	12,837,249	11,075,427	8,719,459	12,245,514	14,773,658	13,474,212	14,064,850	
November	9,780,991	10,685,136	11,415,427	12,159,253	11,025,251	9,086,394	11,542,034	12,503,378	12,760,445	13,562,377	
December	10,299,316	11,189,454	11,496,854	12,636,056	11,376,334	9,720,050	12,108,389	13,017,183	13,673,492	14,055,504	
TOTAL 2ND 6 MOS	59,559,558	65,421,316	69,081,227	73,710,124	60,826,345	46,154,815	70,606,938	78,189,377	78,333,198	81,639,162	

NOTE—(*a*)"Revenue Passengers" for the years 1902 and 1903 do not include passes.

Authority—Monthly records of United Railroads.

TABLE 52.—DERIVED OPERATING STATISTICS, BY UNITS

UNITED RAILROADS

Units	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
PER REVENUE CAR MILE										
Gross Earnings (cents)	30.68	31.94	34.10	36.24	39.02	37.45	35.17	36.34	36.07	35.76
Passenger " "	30.40	31.67	33.80	35.90	38.70	37.15	33.48	34.20	35.85	35.52
Operating Expense, less taxes and depreciation (cents)	15.90	16.65	16.92	16.55	17.82	27.16	21.73	20.68	20.19	19.52
Total Operating Account, including taxes and depreciation (cents)	18.13	19.47	20.95	20.37	21.27	30.37	23.51	23.38	24.46	23.49
Maintenance Revenue Equipment (cents)		1.45	1.85	1.45	1.74	5.37	3.13	3.10	2.57	2.05
Maintenance Total Equipment (cents)	1.61	1.74	2.28	1.75	2.11	6.29	3.64	3.49	2.98	2.43
Maintenance Way and Structures (cents)	1.98	1.81	1.96	2.43	2.18	2.14	1.56	1.58	1.62	1.67
Total Maintenance (cents)	3.59	3.55	4.24	4.17	4.29	8.44	5.21	5.08	4.61	4.10
Cost of Power (cents)	2.29	2.20	2.03	1.85	2.42	3.80	5.51	5.11	4.96	4.45
Platform Expense (cents)	6.90	7.23	7.28	7.08	7.02	7.98	6.60	6.46	6.41	6.38
Revenue Passengers and Free Passes	6.11*	6.38*	6.85	7.28	7.86	7.58	7.06	7.30	7.25	7.13
Total Passengers			10.16	10.83	12.10	12.03	10.05	10.36	10.32	10.15
PER MILE SINGLE TRACK OPERATED										
Gross Earnings (dollars)	24,200	25,400	26,520	27,550	28,510	22,040	29,160	30,350	29,410	30,000
Passenger " "	24,000	25,200	26,290	27,280	28,290	21,860	27,760	28,600	29,240	29,820
Maintenance Track and Roadway (dollars)	817	641	685	950	1,118	816	839	828	1,087	1,120
Revenue Car Miles	78,800	79,600	77,800	75,950	73,100	58,900	82,900	83,600	81,600	84,000
Revenue Passengers	482,000*	507,500*	529,000	548,500	568,000	439,500	582,000	606,500	588,000	591,800
Total Passengers			791,000	824,000	884,000	708,000	832,500	865,000	841,700	851,000
Population	1,553	1,510	1,595	1,664		1,655	1,515	1,650	1,600	1,695
PER CAR HOUR										
Gross Earnings (dollars)				2.75	2.99	2.56	2.78	2.95	2.99	3.01
Passenger " "				2.73	2.96	2.54	2.65	2.78	2.97	2.99
Operating Expense, less taxes and depreciation (dollars)				1.26	1.37	1.86	1.72	1.68	1.67	1.64
Total Operating Account, including taxes and depreciation (dollars)				1.55	1.63	2.08	1.86	1.90	1.85	1.80
Platform Expense (dollars)				0.54	0.54	0.55	0.52	0.52	0.53	0.54
Passengers (total)				82.5				84.0		86.5
PER REVENUE FARE PASSENGER										
Gross Earnings (cents)	5.01*	5.01*	5.01	5.02	5.02	5.02	5.01	5.00	5.00	5.00
Passenger Earnings (cents)	4.97*	4.97*	4.97	4.97	4.98	4.98	4.97	4.97	4.97	4.97
Total Operating Account, including taxes and depreciation (cents)	2.97*	3.05*	3.08	2.82	2.74	4.07	3.35	3.22	3.09	3.03
PER TOTAL PASSENGER CARRIED										
Gross Earnings (cents)			3.36	3.34	3.23	3.12	3.52	3.51	3.50	3.49
Passenger Earnings (cents)			3.25	3.31	3.20	3.09	3.47	3.49	3.48	3.47
Total Operating Account, including taxes and depreciation (cents)			2.06	1.88	1.76	2.53	2.35	2.26	2.16	2.11
PER CAPITA										
Gross Earnings (dollars)	15.65**	16.86**	16.62**	16.55**		13.33**	19.23**	18.40**	18.40**	17.72**
Car Miles	51.00**	52.82**	48.75**	45.65**		35.60**	54.70**	50.70**	51.00**	49.60**
Track Mileage operated per 1000 inhabitants	0.647**	0.655**	0.627**	0.602**		0.605**	0.660**	0.607**	0.625**	0.591**
MISCELLANEOUS RATIOS										
Bank Clearings to Gross Earnings (dollars)	248.00	243.50	230.80	259.50	335.80	449.80	255.80	265.60	303.80	308.30
Transfer to Revenue Passengers			48.30	49.10	54.00	58.70	42.30	41.70	42.30	42.60
Postal Receipts to Gross Earnings (dollars)	23.40	23.20	23.65	25.10	25.35	37.65	29.30	29.70	32.50	32.60

Authority—United Railroads records.
*Not including chartered cars.
**Spring Valley Water Company estimates of population.

TABLE 53. COMPARATIVE RECORD OF PROPORTIONAL RETURNS TO TRAINMEN, PUBLIC, COMPANY

INVESTMENT SUPPORTED ON UNITED RAILROADS SHARE AT VARIOUS RATES OF RETURNS

	1900	1901	1902	1903	1904	1905
TRAINMEN'S SHARE (Platform Expense)	$1,076,062	$1,172,707	$1,245,347	$1,411,917	$1,418,886	$1,380,811
% Total Receipts	22.83	22.80	22.38	22.52	21.24	19.45
PUBLIC'S SHARE (City and State Taxes, Car Licenses)	346,791	362,905	403,337	409,200	376,700	388,880
% Total Receipts	7.35	7.05	7.24	6.53	5.64	5.48
COMPANY'S SHARE (Gross Corporate Income)	1,943,931	2,091,624	2,290,795	2,459,638	2,596,170	3,131,362
Surplus, Interest, Misc. Deductions, Sinking Fund % Total Receipts	41.24	40.65	41.17	39.25	38.86	44.09
Investment Supported at 4%	48,600,000	52,300,000	57,300,000	61,500,000	64,900,000	78,300,000
Ratio Investment to Total Receipts	10.31	10.17	10.30	9.82	9.71	11.03
Investment per Mile Track Owned	218,000*	231,500*	244,000	246,800	258,700	303,000
Investment Supported at 5%	38,900,000	41,800,000	45,815,000	49,200,000	51,920,000	62,630,000
Ratio Investment to Total Receipts	8.25	8.13	8.23	7.85	7.76	8.82
Investment per Mile Track Owned	174,300*	185,200*	195,000	197,400	207,000	242,500
Investment Supported at 6%	32,400,000	34,900,000	38,190,000	41,000,000	43,250,000	52,200,000
Ratio Investment to Total Receipts	6.87	6.77	6.86	6.54	6.47	7.35
Investment per Mile Track Owned	145,300*	154,200*	162,500	164,500	172,500	204,000
Investment Supported at 7%	27,800,000	29,900,000	32,725,000	35,150,000	37,100,000	44,750,000
Ratio Investment to Total Receipts	5.89	5.81	5.88	5.61	5.55	6.30
Investment per Mile Track Owned	124,500*	132,400*	139,300	141,000	147,900	173,300
Investment Supported at 8%	24,300,000	26,150,000	28,650,000	30,750,000	32,450,000	39,150,000
Ratio Investment to Total Receipts	5.15	5.08	5.15	4.91	4.85	5.52
Investment per Mile Track Owned	109,000*	115,700*	122,000	123,400	129,300	151,500

	1906	1907	1908	1909	1910	1911
TRAINMEN'S SHARE (Platform Expense)	$1,069,878	$1,010,857	$1,288,079	$1,324,300	$1,358,985	$1,407,603
% Total Receipts	17.88	21.21	18.65	17.60	17.56	17.67
PUBLIC'S SHARE (City and State Taxes, Car Licenses)	395,363	407,800	347,920	396,200	448,100	404,000
% Total Receipts	6.61	8.56	5.04	5.27	5.79	5.07
COMPANY'S SHARE (Gross Corporate Income)	2,738,195	917,720	2,317,391	2,726,628	2,552,430	2,786,848
Surplus, Interest, Misc. Deductions, Sinking Fund % Total Receipts	45.78	19.26	33.54	36.25	32.98	34.97
Investment Supported at 4%	68,500,000	23,000,000	58,000,000	68,000,000	63,800,000	72,000,000
Ratio Investment to Total Receipts	11.45	4.83	8.40	9.04	8.24	9.04
Investment per Mile Track Owned	265,000	89,000	225,000	258,000	241,000	270,000
Investment Supported at 5%	55,000,000	18,300,000	46,400,000	54,500,000	51,000,000	57,700,000
Ratio Investment to Total Receipts	9.20	3.84	6.72	7.24	6.59	7.25
Investment per Mile Track Owned	213,000	71,000	180,000	206,500	193,000	216,000
Investment Supported at 6%	45,500,000	15,300,000	38,700,000	45,400,000	42,500,000	48,000,000
Ratio Investment to Total Receipts	7.60	3.21	5.60	6.04	5.50	6.03
Investment per Mile Track Owned	176,500	59,300	150,000	172,000	160,000	180,000
Investment Supported at 7%	39,000,000	13,100,000	33,200,000	39,000,000	36,500,000	41,200,000
Ratio Investment to Total Receipts	6.52	2.75	4.80	5.18	4.72	5.17
Investment per Mile Track Owned	151,000	50,800	129,000	148,000	138,000	154,000
Investment Supported at 8%	34,200,000	11,500,000	29,000,000	34,000,000	31,900,000	36,000,000
Ratio Investment to Total Receipts	5.72	2.41	4.20	4.52	4.12	4.52
Investment per Mile Track Owned	132,500	44,500	112,500	129,000	120,000	135,000

NOTE—Year 1902 and following, United Railroads. Years 1900 and 1901, railways which ultimately comprised United Railroads.
*Operated track.
Authority—United Railroads Accounts.

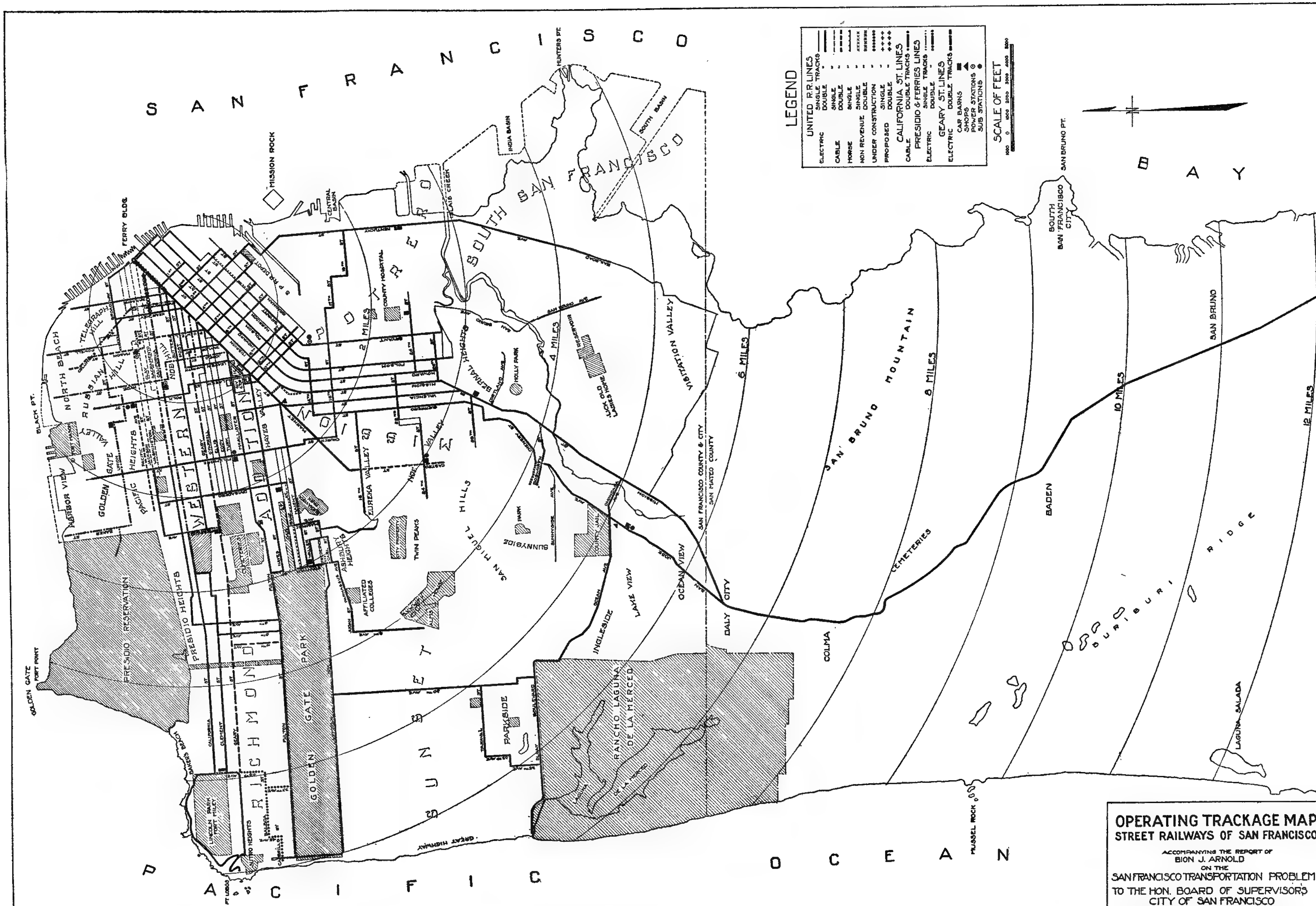


PLATE 1.—OPERATING TRACKAGE MAP.

Plan of all operating street railway trackage in the City and County of San Francisco, and part of the United Railroads trackage in San Mateo County. The legend indicates —(a) track operated, (b) not operated for revenue, and (c) under construction, also single and double track for electric, cable and horse car lines, car barns, car houses, and power substations. The most noticeable feature is the large area unserved within the present city limits, such as Sunset, Merced, San Miguel, University Mound and South San Francisco.

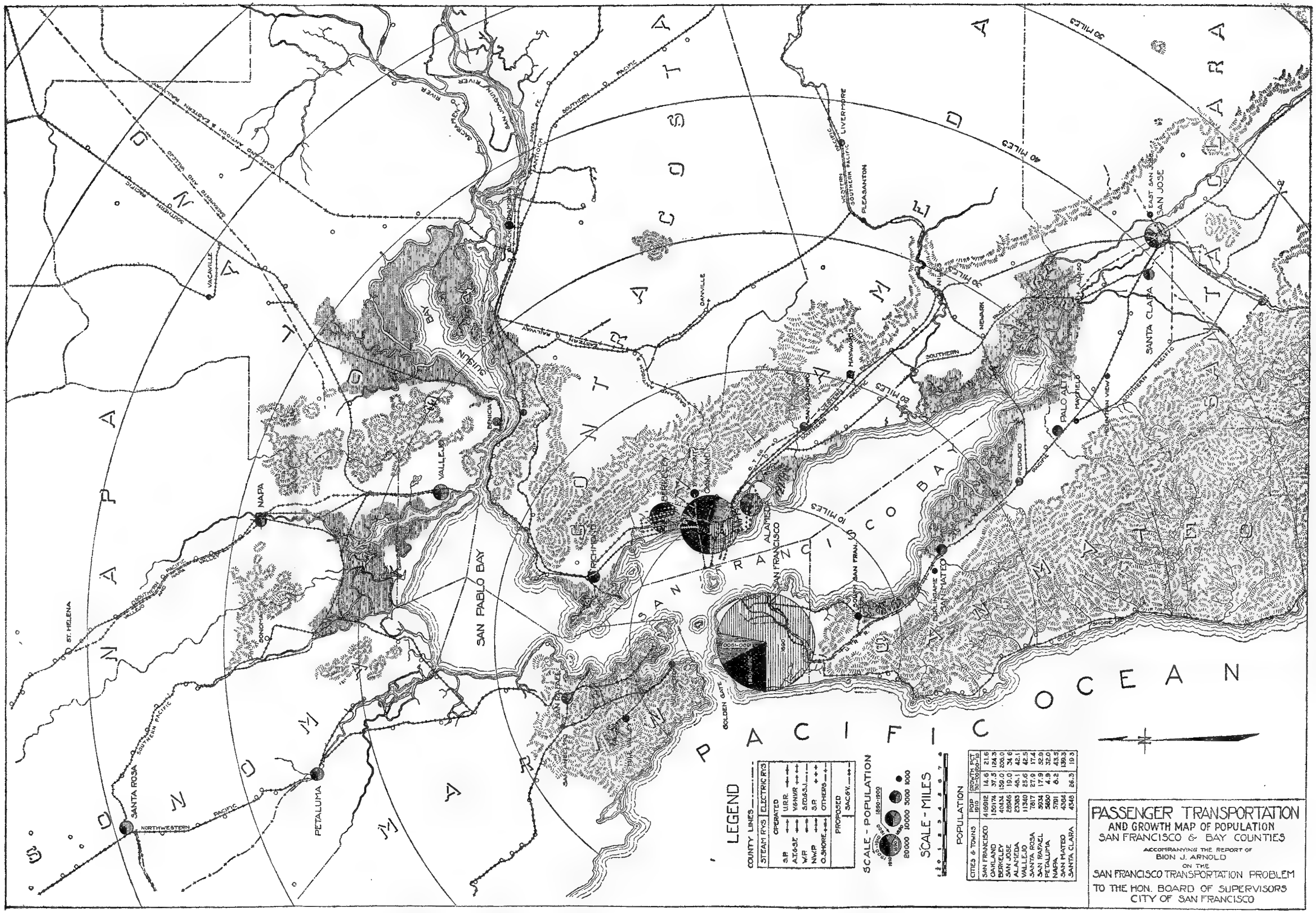


PLATE 2.—GENERAL TRANSPORTATION MAP OF SAN FRANCISCO AND COMMUTER DISTRICT.

Showing relative size of communities in 1910, and their growth within the last two decades. The solid black areas are of great interest in indicating recent growth resulting from the redistribution of population of the Bay cities, as largely influenced by the great fire. The network of transportation lines traversing the bottom lands clearly indicates the limits and possibilities of a great future industrial district surrounding the Bay. The possibilities of rapid electric transit down the Peninsula through the Market Street extension tunnel under Twin Peaks stand out in clear contrast with the enormous success of transbay development by electric trains, even under the permanent handicap of at least 20 minutes more running time via the water routes. This map is the most conclusive argument for a unified and compacted commuter and industrial district under one Metropolitan District Control of utilities and industrial development.

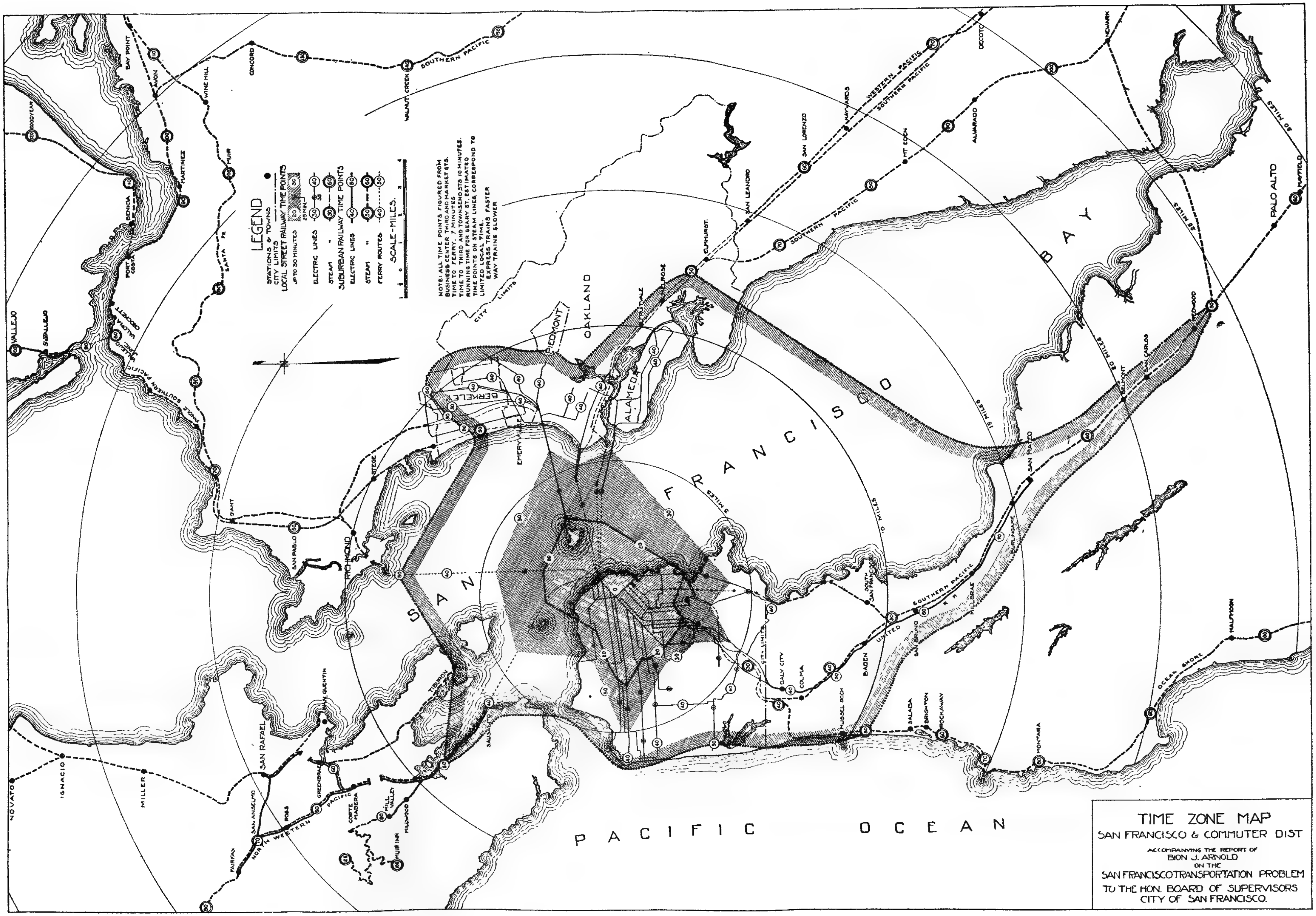


PLATE 3. TIME ZONE MAP—SAN FRANCISCO COMMUTER DISTRICT

While practically half of San Francisco lies within the 30-minute time zone, none of the trans-bay commuters now reach land within that time. All of the trans-bay districts are reached within an hour, the same as San Francisco. But for the former, from one-fourth to one-half of the time is consumed in the water trip. Shaded contour areas and time points within circles indicate how far commuters may ride within 10-minute intervals from the center of the business district—Third and Market Streets (allowing seven minutes to the Ferry terminal, and 10 minutes to the railroad terminal at Third and Townsend Streets). The inner shaded zones correspond to the running time by electric and cable lines. Double circles and the Peninsular zone particularly refer to steam lines. Running speed is indicated directly by the relative distance between these time points. For steam trains, the time shown is on limited local trains passing by only the less important stations. Some limited expresses make 26% better time, and way locals 15% slower time than here indicated. With the same character of rapid transit equipment, it appears that from 20 to 30 minutes more running time will always be necessary, by reason of the water trip, for trans-bay commuters to reach their homes than for San Franciscans, but that no such handicap exists as a limitation for Peninsular development.

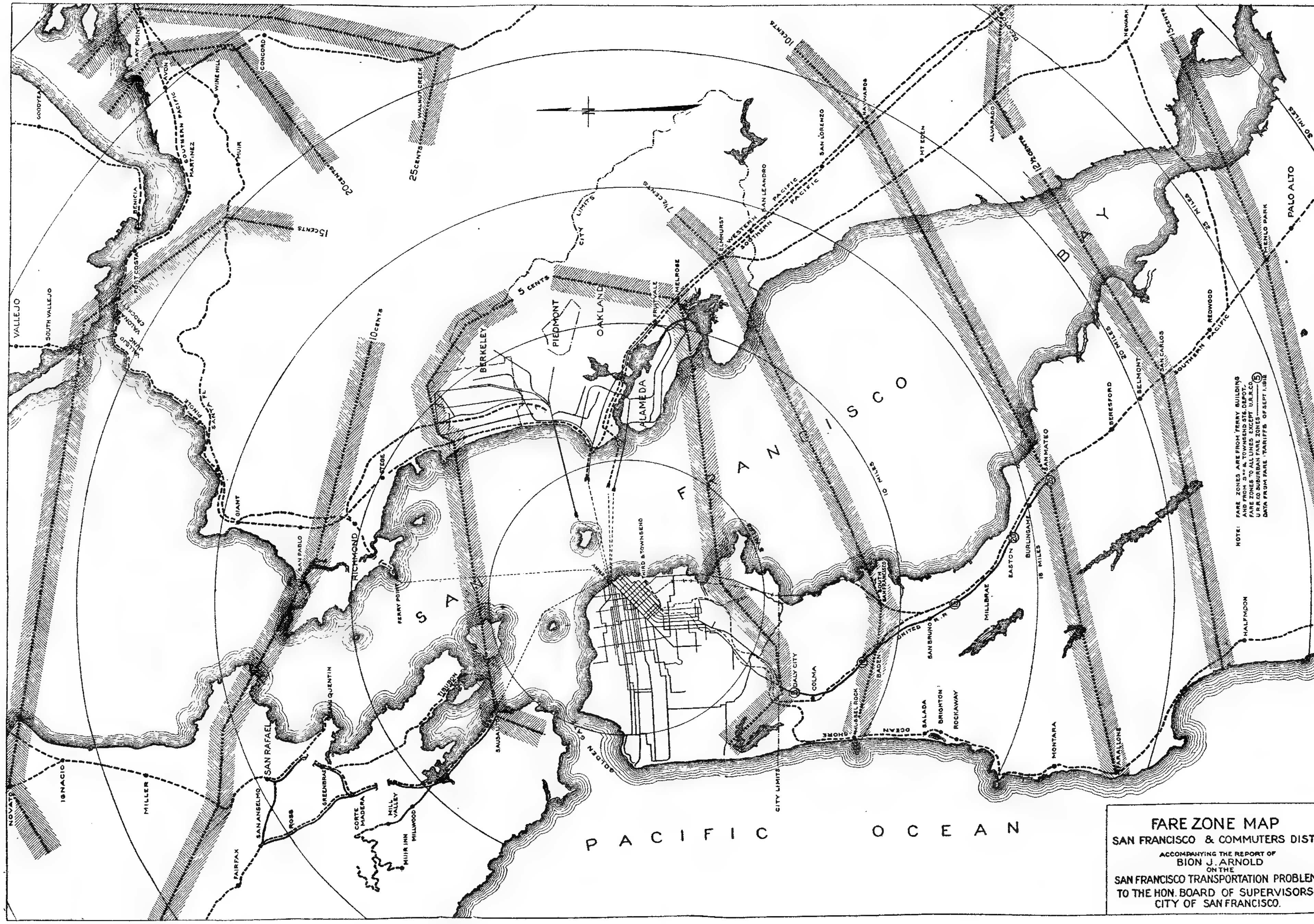


PLATE 4. FARE ZONE MAP—SAN FRANCISCO COMMUTER DISTRICT

Similar to the Time Zone Map, indicating by shaded contour lines the commuter areas covered within successive fare zones of 5, 10, and 15 cents, etc., all of these fares figured from the present terminal points in San Francisco, viz.: the Ferry terminal and the railroad depot. From the business district, an extra 5-cent fare should be added for commuters riding to the Ferry or Depot. These fares are the lowest regular rates obtainable in the form of monthly commuter books. For the San Mateo electric line, fares are indicated in circles, as no commutation rates are available. Revenue per passenger-mile is indicated by the relative distance between these fare zones. From a fare standpoint, San Francisco, Oakland, Berkeley, and Alameda are already unified, while Peninsular development is automatically placed under a handicap of considerably over 100% for local service, and 200% for express service, in excess of the basic cost of transportation within the 5-cent zone. While the 5-cent commuter fare reaches to the north of Berkeley, a fare of 13 1-3 cents is charged for the same time-distance, that is, to about Redwood Station, or midway between the corresponding limits of way local time to Beresford (11.68 cents fare), and limited express time to Palo Alto (15.83 cents fare).

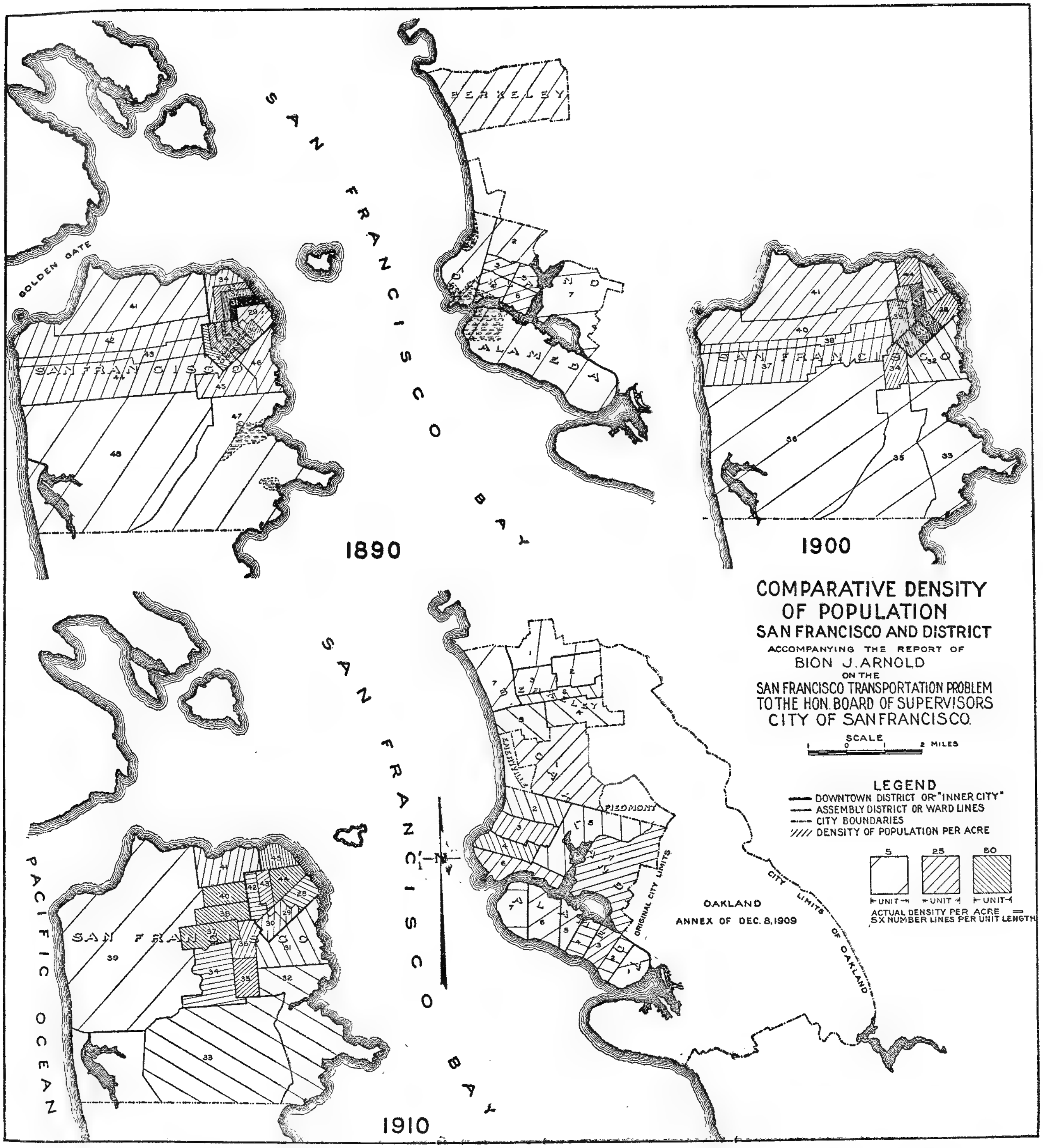


PLATE 5.—GROWTH AND DENSITY OF POPULATION OF BAY CITIES BY ASSEMBLY DISTRICTS, 1890-1910.

A study of this nature is invaluable in indicating the migration of residents to and from various local districts. Unfortunately, the district boundaries have been changed from time to time, but it is quite apparent that the population of the "inner city" has largely scattered to the suburbs, especially since the fire. The varying spacing between the cross section lines indicates relative density in persons per acre. Incidentally, the map shows the rapid growth of Oakland, Berkeley and Alameda in the meantime.

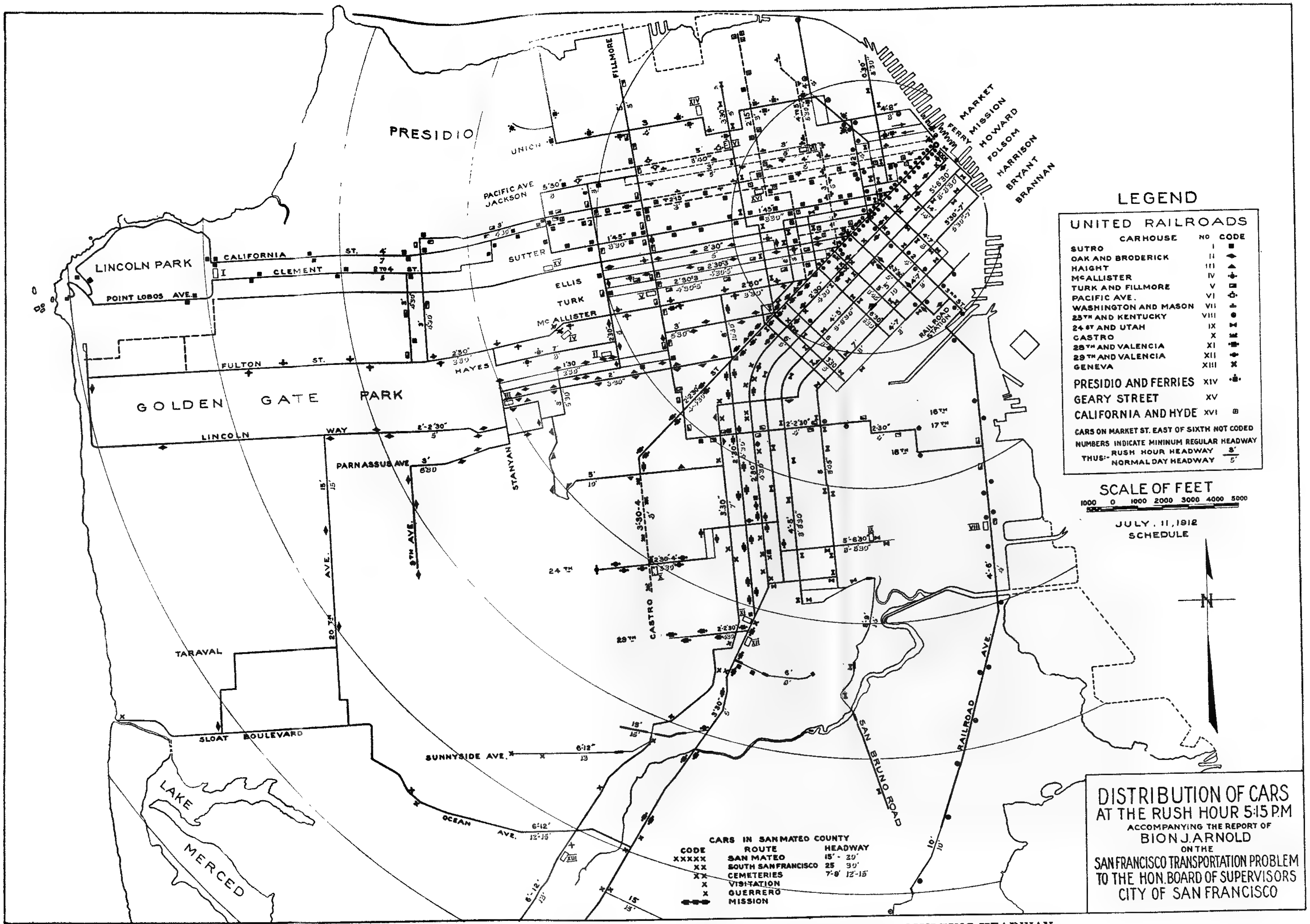


PLATE 6.—DISTRIBUTION OF CARS THROUGHOUT THE CITY DURING RUSH HOURS AND RESULTING HEADWAY.

Showing location according to schedule of all cars at 5:15 p. m. Cars operating out of the various car houses are indicated by distinct characters, shown in the legend, except on lower Market Street, where they are so close as not to permit coding. Scheduled headway is also indicated for both rush hours and for midday, *i. e.*, the average headway resulting from the schedules in operation, assuming reasonably uniform dispatching. Note the congestion resulting from Western Addition lines converging into Market Street. Geary Street line is omitted, as the operating schedule has not been permanently established.

Table 55
(Cont'd)

FUTURE FRANCHISE EXPIRATIONS, UNITED RAILROADS

1940

Street	From	To	Term of Grant	Date of Expiration	Remarks
Embarcadero	Jackson	Broadway	50 yrs.	Dec. 23, 1940	Not built for some years after grant.
Broadway	Embarcadero	Columbus			
Divisadero	Vallejo	Sacramento	50 yrs.	Dec. 23, 1940	Never built from Jackson to Vallejo.
Sacramento	Walnut	Arguello Blvd.			
First Ave.	Sacramento	Lake	50 yrs.	Dec. 23, 1940	
Lake St.	Arguello Blvd.	California			
O'Farrell	Hyde	Scott	50 yrs.	Dec. 29, 1940	Originally double track, changed to single.
O'Farrell	Scott	Divisadero			
	East ½-block from Scott		45 yrs.	Dec. 29, 1940	
	West ½-block to Divisadero				
Eddy	Market	Divisadero			
	Market	Hyde	50 yrs.	Dec. 29, 1940	
	Market	Divisadero	50 yrs.	Dec. 23, 1940	
Hyde	Eddy	O'Farrell	50 yrs.	Dec. 29, 1940	Not operated from Eddy to Ellis.
Scott	O'Farrell	Fell			Tracks taken up on Scott, Fell and Baker Streets about 1896.
Fell	Scott	Baker	50 yrs.	Dec. 29, 1940	
Baker	Fell	Page			
Page	Masonic	Stanyan	50 yrs.	Dec. 29, 1940	
Steuart	Howard	Harrison	50 yrs.	Dec. 23, 1940	
Bryant	Spear	2d	50 yrs.	Dec. 23, 1940	Never built from Spear to Stanley Place.
Brannan	Beale	First	50 yrs.	Dec. 23, 1940	Never built.
Stanley Place	Bryant	Harrison	50 yrs.	Dec. 23, 1940	
Harrison from Steuart to 14th to Guerrero to San Jose Ave. to 30th Street to Chenery to Diamond to San Jose Ave. (Old San Jose Road) to County Line.			50 yrs.	Dec. 23, 1940	Not operated since 1906 from Stanley Place to 3d Street.
18th from Guerrero to Falcon, thence returning on "Switch back" to Corbett Road to Clayton Street to Ashbury to Frederick.			50 yrs.	Dec. 23, 1940	
Clayton	Frederick	Waller	50 yrs.	Dec. 11, 1940	
Waller	Clayton	Stanyan			
Clayton	Page	Waller	50 yrs.	Dec 29, 1940	Not operated.
Cole	Waller	Parnassus	50 yrs.	Dec. 29, 1940	Not operated.
Parnassus	Cole	Stanyan			
Carl	Cole	Stanyan	50 yrs.	Dec. 29, 1940	

1941

UNITED RAILROADS

Eighth from Brannan to Kansas, thence to 17th to Connecticut to 18th to Kentucky.	50 yrs.	Nov. 18, 1941	Never built from 8th and Brannan to Kansas and thence to 16th
4th from Berry to Kentucky to Railroad Ave. to San Bruno Ave. southerly to a point 20 ft. north of County Line.	50 yrs.	Nov. 18, 1941	Franchise not to go into effect until surrender of Potrero and Bay View franchise on same streets. No record of such surrender.

1942

UNITED RAILROADS

16th from Kansas to Church to Duboce to Fillmore, Turk and Post, to Bay of San Francisco.			50 yrs.	June 3, 1942	Not operated from Bay Street to Bay of S. F.
Divisadero	Sacramento	Page	50 yrs.	Dec. 6, 1942	
Balboa ("B")	Arguello	19th Ave.	50 yrs.	June 3, 1942	Never built
19th Ave.	Balboa	G. G. Park			
22d	Howard	Chattanooga	50 yrs.	Dec. 6, 1942	
Dolores and Chattanooga	22d	24th	50 yrs.	Dec. 6, 1942	
24th	Dolores	Hoffman	50 yrs.	Dec. 6, 1942	
20th	Kentucky	Maryland	50 yrs.	Dec. 6, 1942	Not operated.

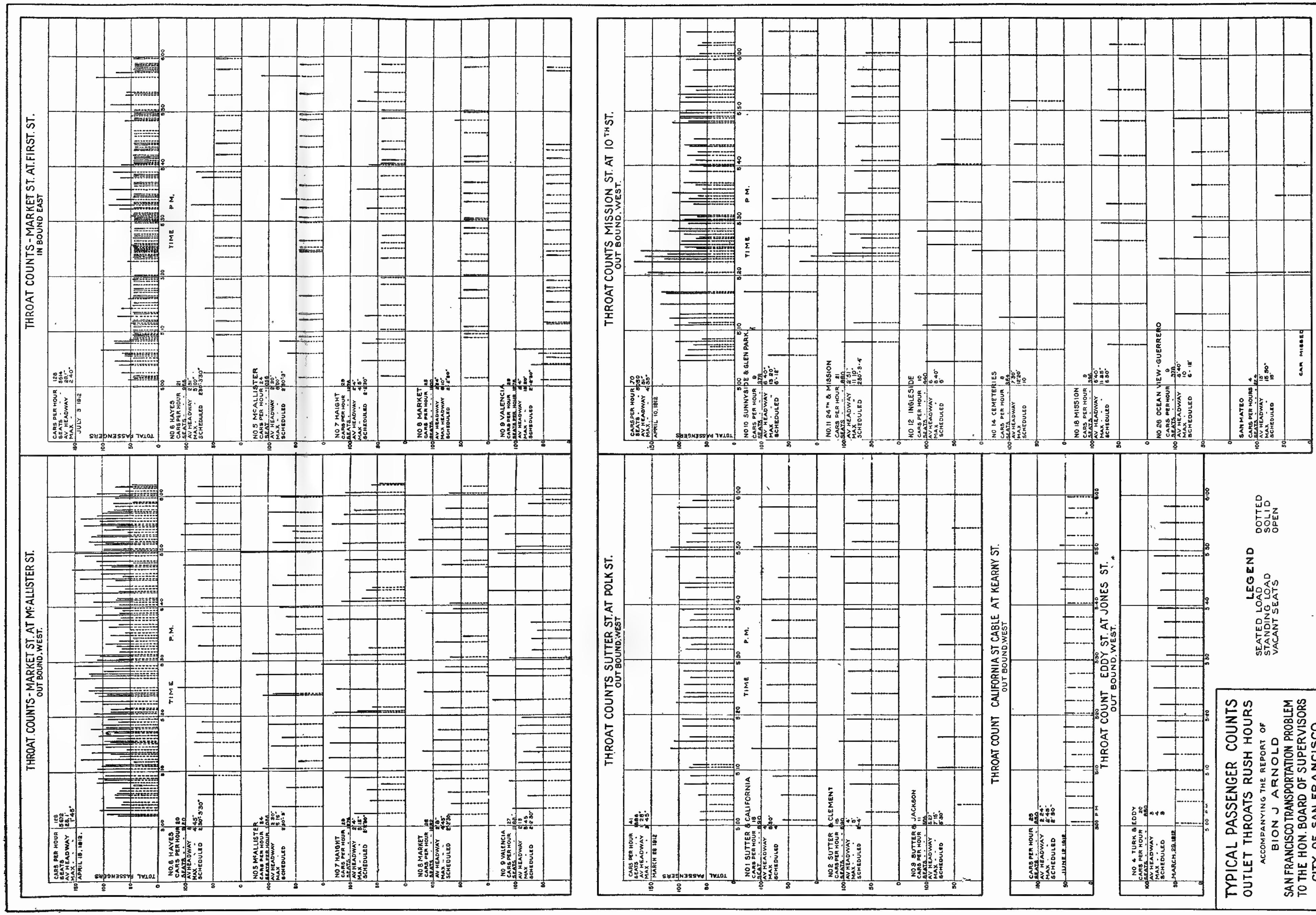


PLATE 7.—TYPICAL RECORD OF PASSENGER COUNTS AT VARIOUS THROATS OF OUTBOUND RUSH-HOUR TRAVEL.

This diagram shows with what degree of regularity cars are operated, maximum loading of cars as compared with seats, results of delays in increasing car loading, variation in riding habit during the rush hour, the comparatively small volume of traffic toward the Ferry, the peculiar uniformity of California Street cable travel as compared with the wide fluctuation in travel on electric lines, and the actual headway along trunk lines resulting from the operation of tributary routes. Note the great necessity for the avoidance of delays so as to make uniform headway possible, as long gaps between cars usually result in excessive car loads.

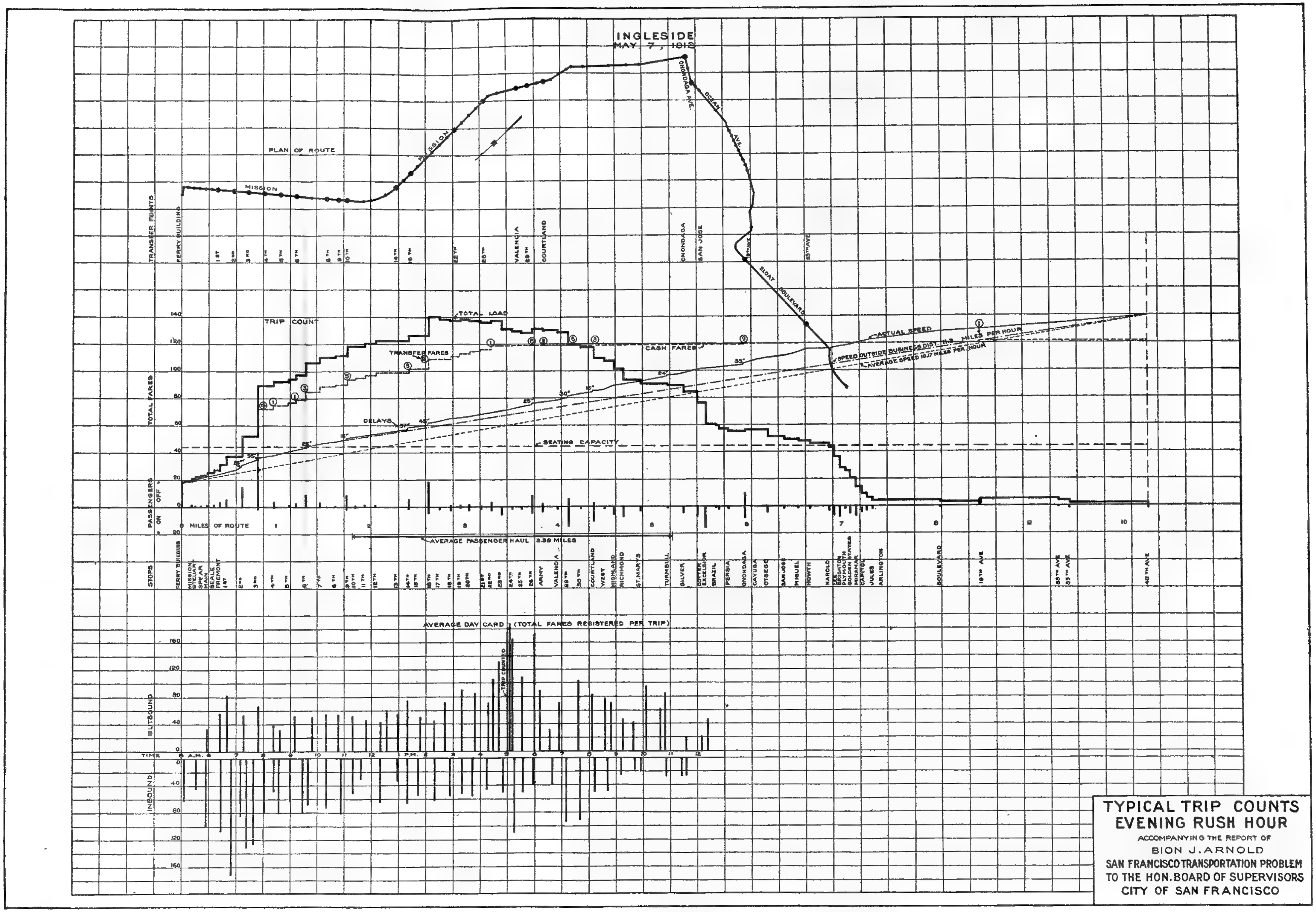


PLATE 8(a)—TYPICAL TRIP COUNTS BY INDIVIDUAL ROUTES

Graphical record of the results of trip counts, showing the complete route characteristics, location and number of stops with number of passengers boarding and alighting at each, total load, seating capacity, standing load, total and average passenger haul, running time with delays, average speed, cash and transfer fares. To determine whether the particular trip was representative, the record of the route by trips for the entire day is appended showing the total fares reported by the conductor. Every trip during the day is not plotted—only typical trips for each half-hour during the midday and for the heaviest part of the rush hour. Possible transfer points are indicated by circle and stops by dots on the plan.

Ingleside. Average trip, typical of Mission routes, showing heavy loading at Third Street, slow speed and delays through loading district, which extends over 2½ miles from the Ferry terminus; standing load nearly 6 miles; abrupt dropping of load in Lakeview tract, and long haul of an almost empty car to the end of the line—a distance of three miles. The average ride of 3.38 miles per passenger is the longest of any line in San Francisco. Excessive loading up to about Silver Avenue and very light load beyond Lee Street indicates the need of a short-run line for relief. Onondaga Avenue is the logical turn-back point.

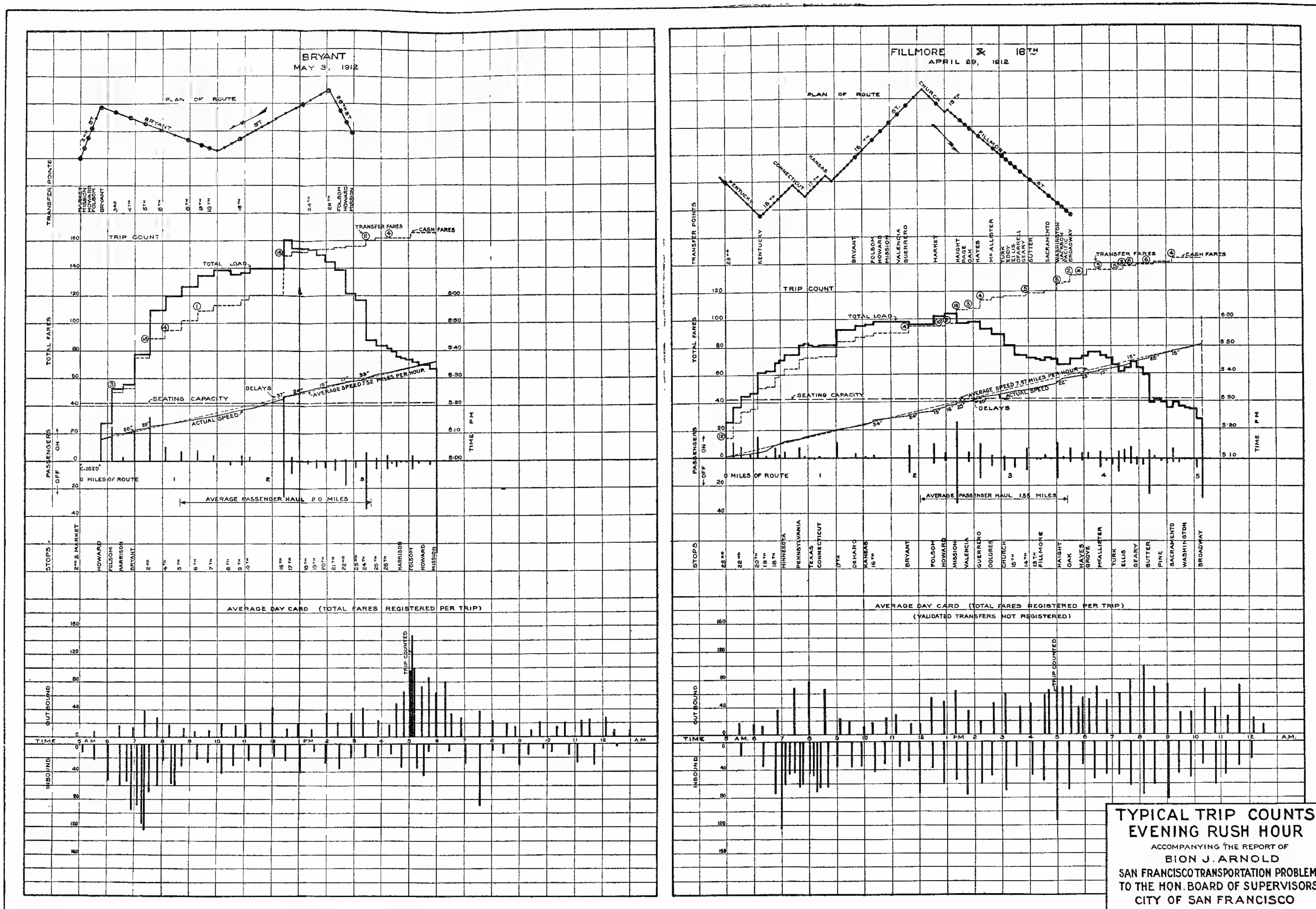


PLATE 8(b).—TYPICAL TRIP COUNTS BY INDIVIDUAL ROUTES.

For General Characteristics See Plate 8 (a).

Bryant Street. Short-run line with excessive overload and low speed due to frequent stops; average passenger ride above the ordinary, although the car haul is very short, and the large number of passengers riding to the outer terminus indicates the need of extension of the line south in Mission Street. The heavy exchange of passengers and particularly the large number of transfer passengers boarding at 16th Street is an indication of the desirability of a parallel route from Kentucky Street out Mission or Bryant during the rush hour. The trip counted was the heaviest of the day.

Fillmore and Sixteenth. Typical cross-town line carrying transfer load of 41% of cash collected. Standing load for practically the entire length of line, but not distinctly excessive at any time. Speed low due to many stops and steep hills. Heavy load carried to end of line transfers to Fillmore Hill extension. Trip counted about average for the hour.

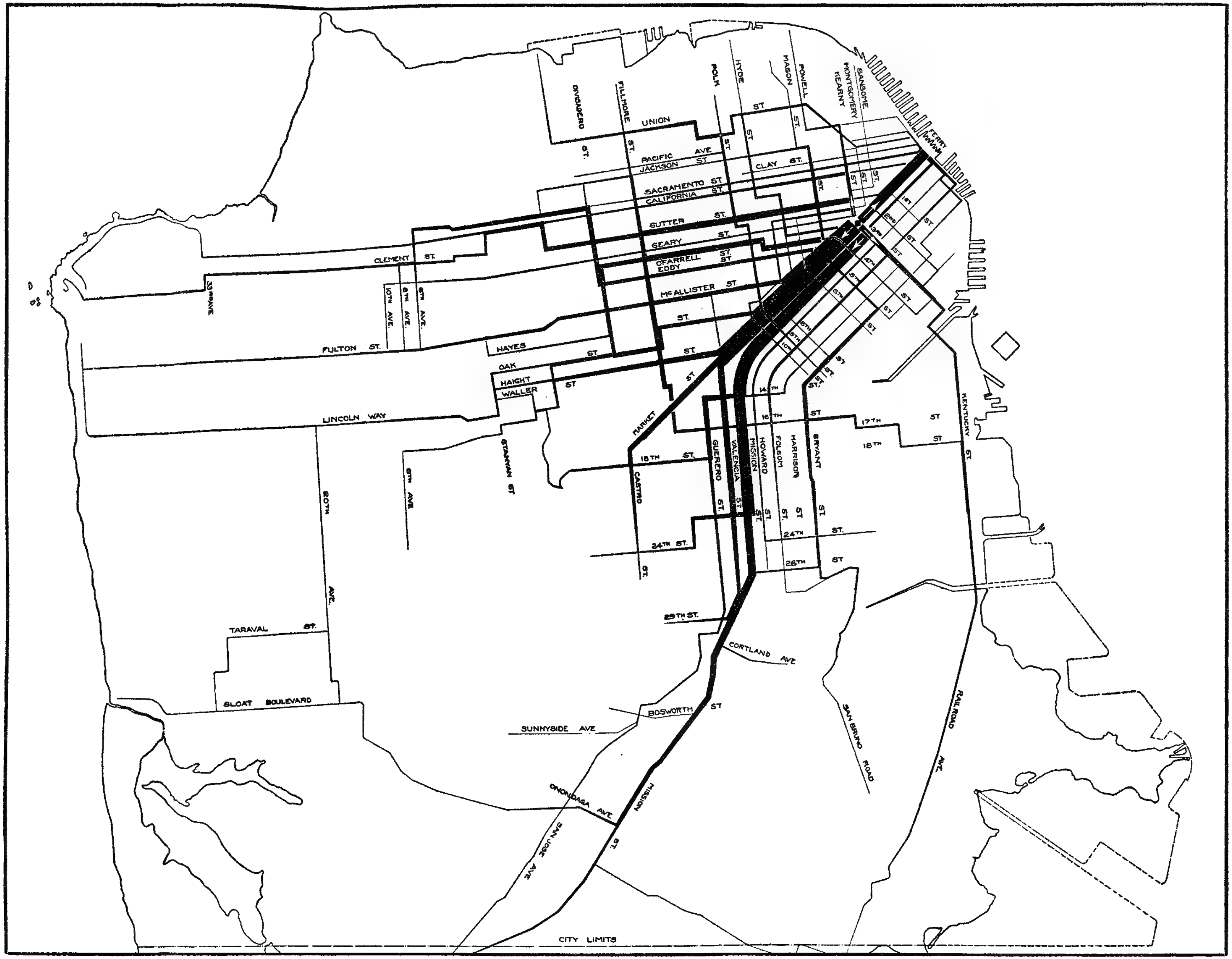


PLATE 9—PASSENGER FLOW FOR THE ENTIRE SYSTEM.

Indicating the relative importance of the various streets as thoroughfares for outbound rush hour travel as shown by the widths of the lines. The heavy outbound traffic on Market and Mission Streets is apparent, as compared with streets south of Mission and with some of the Western Addition streets. Ferry-bound traffic is light as compared with outbound Market Street travel but is heavier than any other street except Mission Street. The gradual decrease in car load towards the outer termini clearly indicates that car service should be tapered off to follow traffic needs.

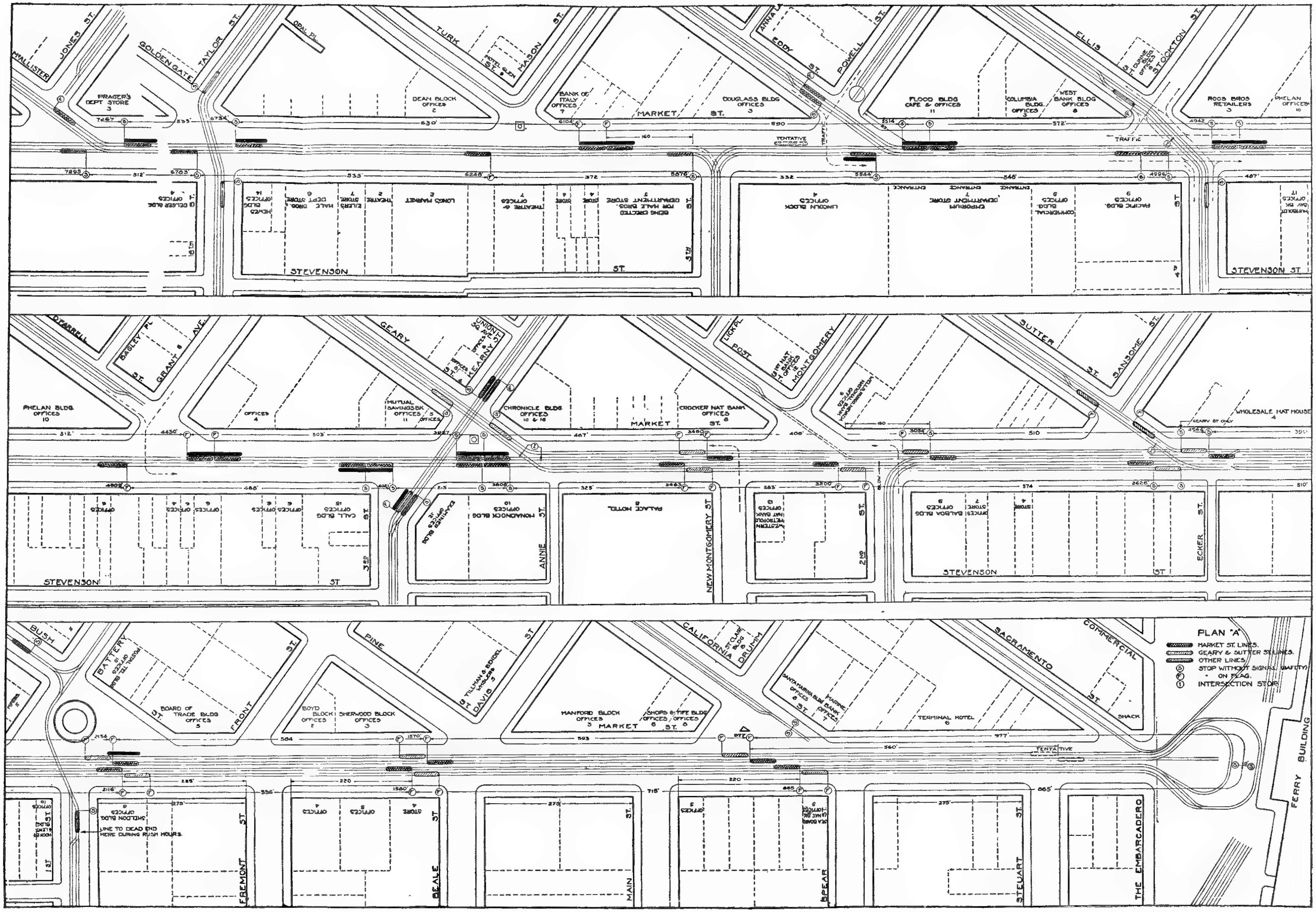


PLATE 10.—FOUR-TRACK PLAN OF STOPS AND STATIONS FOR LOWER MARKET STREET AS RECOMMENDED, PLAN A.

This plan involves relocating and lengthening some of the present safety stations, thereby securing better distribution of service. "Near side" stops only are contemplated, thus abolishing many unnecessary stops now made, and two-car tandem stops are used at heavy traffic points. The rearrangement of the Ferry loop terminal is not considered in this study. West of Sixth Street a break is made in the drawing so as to include McAllister Street intersection. One car is indicated at every possible stop.

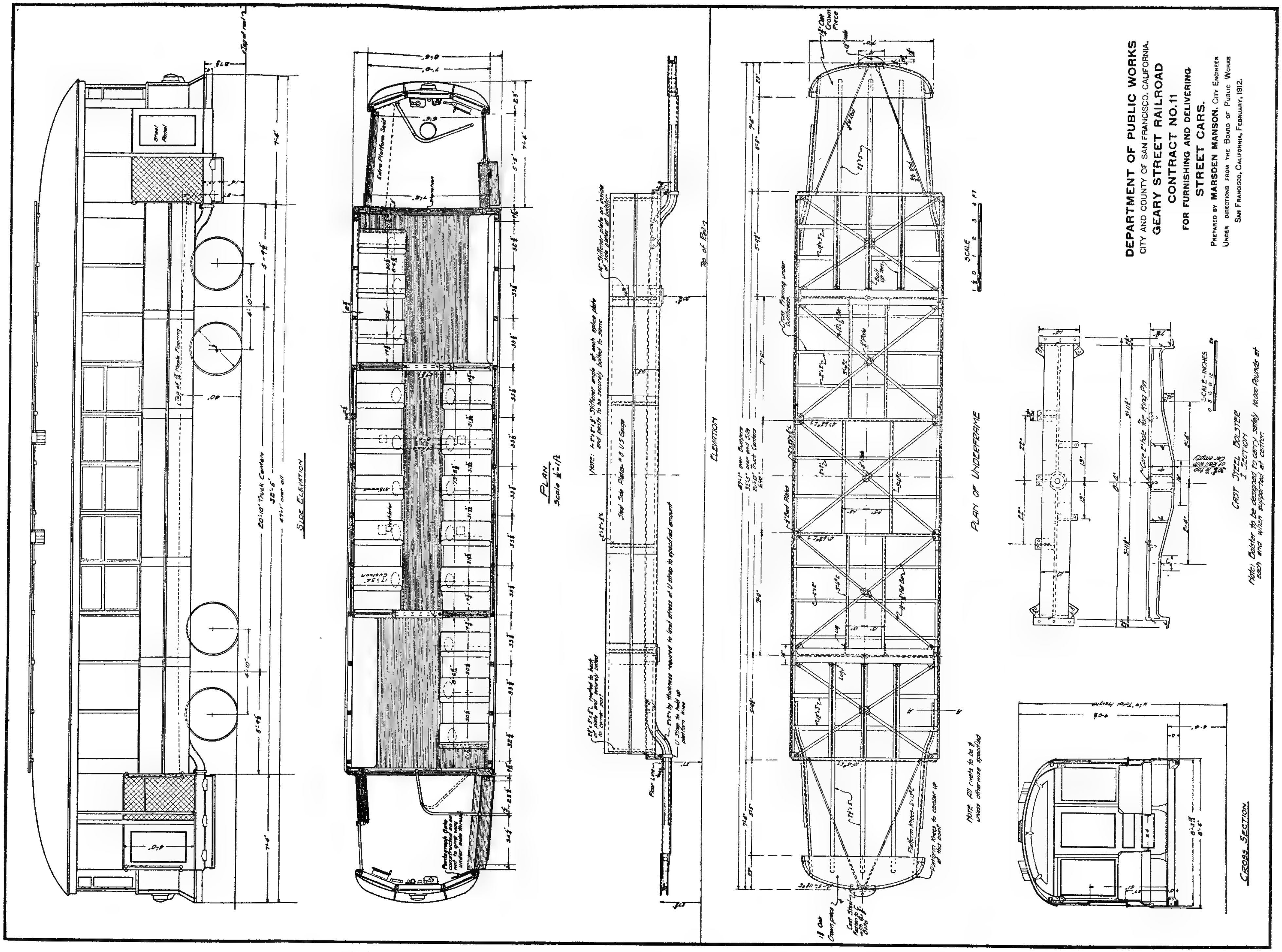


PLATE 11.—MUNICIPAL RAILWAY CAR, GENERAL DESIGN AND ARRANGEMENT.

The design of this car represents a marked departure from previous San Francisco practice in the provision of drop platforms, prepay type, with an open "California" type body. Particular attention has been given to the provision for rapid loading, essential in San Francisco; by proper shaping of the guide railing and the use of a small master controller, an ample entrance width has been obtained. Similarly, on the forward end, with the guide railing behind the motorman, rapid unloading is obtained by locating the exit gate next to the open bulkhead. The seating arrangement is designed to provide the maximum number of cross seats consistent with reasonable capacity, and maximum standing space is provided where most needed, *i. e.*, opposite the entrance. By using raise sash and thin plate girder sides, the width of the car has been reduced eight inches, with practically the same aisle as in the present McAllister Street type of car. Accidents have been minimized by using folding steps. Great rigidity has been secured by under framing of all steel construction and plate girder sides.

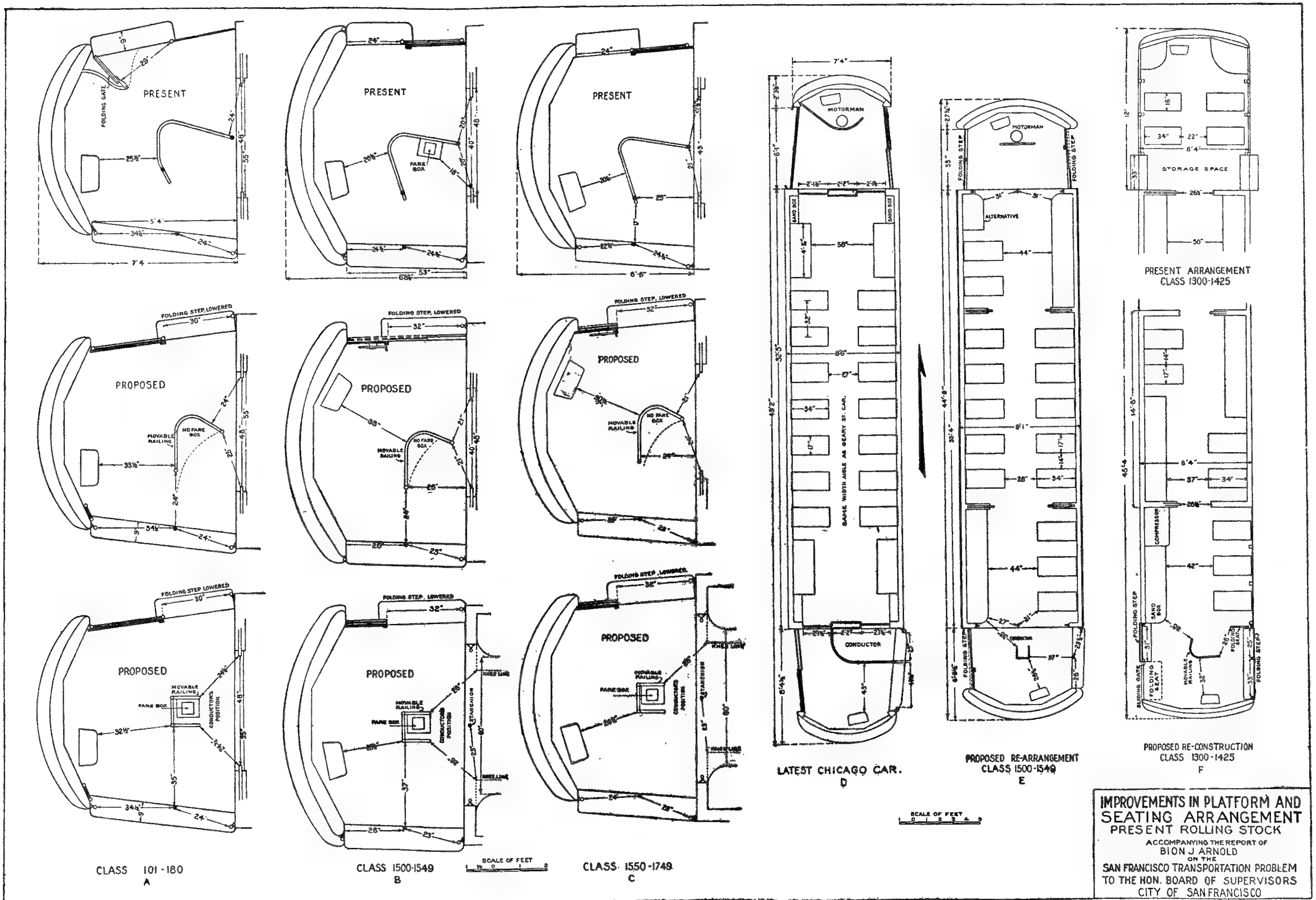


PLATE 12.—RECOMMENDED IMPROVEMENTS IN PLATFORM AND SEATING ARRANGEMENTS, PRESENT UNITED RAILROADS CARS.

Ample platform space and comfortable standing capacity constitute important features of high class equipment. These rearrangements in platform apparatus are recommended as an alternative to lengthening the platforms, as was done in Chicago on cars of the McAllister Street type. Proposed arrangements are shown both with and without a fare box. Note the increase in platform storage space provided at entrance by the proposed plans. To increase the loading speed, it is necessary to either remove the bulkhead or move the controller on all cars of 1500 and 1550 classes. The latest car used in Chicago, Plan D, has platforms fully 22 inches longer than most of the large San Francisco cars, and can be loaded very rapidly, due to the unobstructed passageways provided. An aisle 27 inches in width, the same as on the Municipal car, has proven satisfactory. Plan E shows the proposed rearrangement of the 1500 class, using a seating plan similar to the Municipal car, with the "Cleveland" fare box railing. The 1300 class may be reconstructed into a prepayment car by lengthening platforms, as shown in Plan F.